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Sonia Bhalotra
Abhishek Chakravarty
Selim Gulesci

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Sonia Bhalotra
University of Essex and IZA

Abhishek Chakravarty
University of Essex

Selim Gulesci
Bocconi University

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

The Price of Gold: Dowry and Death in India*

Dowry is often adduced as an explanation of son preference in India, but there is little evidence that dowry motivates son-preferring behaviours. On the premise that gold is an integral part of dowry, we use variation in gold prices to investigate this. First, we exploit a sharp unexpected rise in the price of gold in 1980 and, using a difference-in-discontinuities design, find that the gold price hike is mirrored in an increase in girl relative to boy mortality in the neonatal and infant period. We also find that surviving girls are shorter. Second, using monthly time series data for 35 years, we again find that cyclical variation in gold prices is reflected in excess girl mortality and, since the introduction of prenatal sex determination technology, in the sex ratio at birth. This constitutes the first evidence that dowry costs lead parents to eliminate foetal and newborn girls, and on a scale much larger than "dowry deaths" amongst married women which have been the subject of public attention.

JEL Classification: I14, J16, O12

Keywords: dowry, son preference, missing girls, infant mortality, commodity price shocks

Corresponding author:

Sonia Bhalotra
Department of Economics
University of Essex
Wivenhoe Park
Colchster CO4 3SQ
United Kingdom
E-mail: srbhal@essex.ac.uk

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1 Introduction

Dowry, a transfer of parental property at the marriage of a daughter, is an ancient tradition thought to date back to at least 200 BCE, and widely prevalent in medieval western Europe[1] While this tradition has virtually disappeared with modernization in most of the rest of the world, it persists in contemporary India and has become increasingly common in Bangladesh, Pakistan, and Sri Lanka. Today, dowry payments in India are almost universal, and although systematic time series data on dowry payments are scarce, sample surveys indicate that they are rising.[2]

Dowry is often adduced as a motivation for son-preference in India (Miller (1981), Harris (1993), Gupta et al. (2003))[3]. Dowry is a considerable tax on the families of girls, with estimates indicating that it is often 4 to 8 times annual household income or close to 70% of wealth (Anderson (2007), Rao (1993)). Families appear to start saving for dowry as soon as a girl is born (Browning and Subramaniam (1995)), and when income constrained may be forced to sell productive assets including land in order to afford dowry payments (Gupta (2002), Kodoth (2005)). While the original dower payments acted as a pre-mortem bequest to daughters that afforded them post-marital financial protection, property rights over dowry are now often appropriated by the groom or his parents rather than retained by the bride, and this tendency appears to be increasing, at least initially, in economic development (Anderson and Bidner (2015)). Overall, dowry in India tends to impoverish families with daughters, lowering the utility from having a daughter, with the utility cost increasing in the cost of dowry. This makes it plausible that dowry costs motivate a preference for having sons, and several previous studies implicate dowry (Arnold et al. (1998), Miller (1981), Harris (1993), Gupta et al. (2003)), but there is in fact no clear evidence of causal effects of dowry costs on son preferring behaviours.

We provide the first evidence that dowry costs lead to foetal and infant mortality among girls. We contribute new and, we argue, compelling evidence to a small literature on dowry (Rao (1993),

[1]Surveys of historical research are provided in Anderson (2003), Botticini and Siow (2003)), Hughes (1978), Tambiah and Goody (1973).

[2]On the prevalence of dowry in India, see Anderson (2007), and the Survey of Status of Women and Fertility (SWAF) 1993-94 which indicates that as many as 90% of marriages involve bridal dowry (Smith et al. (2000)). Dowry inflation is discussed in Rao (1993) and Anderson (2003).

[3]Possibly competing explanations include funeral procedures, old age security and gendered labour market opportunities and returns

Bloch and Rao (2002), Anderson (2003), Anderson (2007), Sekhri and Storeygard (2014)) as well as to a larger literature on India's 'missing girls' (Sen (1992), Sen (2003), Bhalotra and Cochrane (2010), Anderson and Ray (2010)).

Perhaps because dowry has been prohibited in India since 1961, data on dowry have been largely unavailable and this is no doubt a reason for the scarcity of previous work. However, even if data on dowry payments were widely available, researchers would need to address the problem that they vary endogenously with family preferences and characteristics including wealth, education and caste in micro-data[4], and with population sex ratios in time series data[5].

We avoid these problems by using exogenous variation in the burden of dowry created by variation in gold prices on the world market. India has historically imported more than 90% of its gold stocks, making the international price relevant (Reserve Bank of India (2013)). Gold, typically in the form of jewellery, is an integral part of dowry in India (see Section 2).

We adopt two complementary approaches. First, we exploit a gold price hike of unprecedented magnitude that occurred in 1980, using a regression discontinuity design (RD). In particular, we use the difference-in-discontinuities estimator, testing whether neonatal (i.e. birth month) and infant (i.e. birth year) mortality rates for girls born in the months just after the gold price shock relative to girls born in the months just before the shock were higher than the corresponding difference among boys. While RD on month is effective in eliminating the most likely confounders, we also use a time series approach which directly uses gold price data and which, by covering the longer period, 1970-2005, addresses the generality of the RD results. Using the time series data, we model the gender differential in neonatal and infant mortality rates as a function of cyclical variation in (filtered) gold prices in the month of birth.

Both approaches indicate that excess girl mortality in the neonatal and infant period is systematically positively related to international gold prices. The estimated effects are substantial. The 1980 peak in gold prices was associated with an increase in excess girl neonatal (infant) mortality of 4.3 (9.1) percentage points among Hindus. There was no significant change in excess girl

[4]See Bloch and Rao (2002), Deolalikar and Rao (1998), and Table A.12 in this paper.

[5]Rao (1993), Edlund (2000)).

mortality among non-Hindus (Muslims, Christians and other), consistent with a stronger tradition of dowry and of biased sex ratios among children in the Hindu community.

The time series data produce similar results, showing that Hindus and only Hindus respond to gold prices changes. A one standard deviation change in (filtered) gold prices is associated with an increase in girl relative to boy neonatal mortality of almost 0.3 percentage points, which is large, being close to half of the baseline mortality rate of boys. The time series results establish that the RD results are not driven by something particular about 1980, and that parents also respond to smaller changes in gold prices.

The mechanism driving excess postnatal mortality is likely to be neglect in nutrition and health inputs. While neglect will succeed in eliminating girls some of the time, some girls will inevitably survive it. For survivors, we obtain RD estimates for height since a number of studies document that adult stature is sensitive to childhood nutrition (Bozzoli et al. (2009), Akresh et al. (2012)). We find that Hindu girls who were exposed to the 1980 gold price hike at birth but survived are 0.72 centimeters shorter in early adulthood. This result supports the hypothesis of neglect.

Since the mid-1980s, when prenatal sex detection technologies were first introduced in India, parents have been substituting female foeticide, a more deliberate choice, for postnatal neglect (Anukriti et al. (2015); Section 2 below). So as to investigate whether behavioural responses to gold prices exhibit a similar shift, we divide the time series sample in the mid 1980s. We find that, pre-ultrasound, gold price variation is reflected in differences in postnatal mortality while, post-ultrasound, it is reflected in the sex ratio at birth. Among Hindu households, during 1970-1985, a one s.d increase in gold prices is estimated to lead to a 0.6 percentage point increase in excess girl neonatal mortality, and during 1986-2005, the same increase in gold prices results in an approximately 0.75 percentage point decline in the probability that a girl rather than a boy is born.

We find no increase in boy mortality in March 1980 and, in some specifications, a significant decrease. We show that the RD estimates do not simply reflect a seasonal process that elevates the chances of girl relative to boy mortality by implementing a series of placebo tests for the March of neighbouring years. Since oil and gold prices are correlated (albeit with a lag), we control for monthly oil prices, and also for food prices and rainfall shocks. The estimated gold price effects are robust to these tests. This is important as it is only gold prices (and not oil or food prices) that are directly related to dowry costs.

Our contention that the estimated effects are on account of dowry costs is further supported by our finding of systematic heterogeneity in treatment effects by different indicators of son preference. The sub-samples where we would expect dowry costs to activate son-preferring behaviours are precisely the sub-samples in which we detect statistically significant and large effects. These are states with a historic record of stronger son preference (Sen (2003), Bhalotra et al. (2010), Bhalotra and Cochrane (2010)), and Hindu households in which the first born child is a girl (Abrevaya (2009), Bhalotra and Cochrane (2010)). Even if we have established that it is gold prices that influence son-preferring behaviours, it is relevant to consider whether the results are driven by price effects or by income or wealth effects of gold price changes. We assess this and argue that the results are driven by price effects.

Our finding that foetal and early childhood girl mortality rises when gold prices rise suggests that families have static expectations. If gold prices follow a random walk then the rational expectation is the static expectation (M. Brückner and A. Ciccone (2010), Deaton and Laroque (1992)). Using the time series of monthly gold prices, we demonstrate that gold prices follow a random walk. We also investigate how gold price variation reflects in dowry value. Using some of the scarcely available data on dowry payments, we show that we cannot reject a unit elasticity. This establishes a premise of our analysis (the relevance of gold prices to dowry costs), and it shows that the content or composition of dowry does not adjust to the price of gold so as to keep its value fixed. In line with this, Vaidyanathan (1999) shows that gold demand in India is price inelastic.

The rest of the paper is organized as follows. We present relevant contextual material on gold, dowry and son preference in India in Section 2. The empirical strategy is described in Section 3, where we specify the regression discontinuity design, the time series approach, and a range of specification checks. We discuss auxiliary investigations of, first, the time series properties of gold prices and, second, the relationship between dowry value and gold prices in Section 3.3. A brief description of the data and descriptive statistics is in Section 4, and the main results are detailed in Sections 5, 6 and 7. Results from the auxiliary tests are described in Section 8. Section 9 presents a discussion of the findings, and Section 10 concludes.

2 Background

2.1 Gold Prices and Dowry

The 1980 gold price shock constituted a historically unprecedented peak. See Figure 1 which shows the monthly time series of gold prices during 1950-2005, and Figure 2 which zooms in on the neighbourhood around the 1980 peak indicated by the optimal bandwidth algorithm. Prices peaked in February and are recorded for the end of the month. As discussed below, we find responses for children born in March. The price of gold in February 1980 was 27.54% percent higher than in January 1980 and 179.41% percent higher than in February 1979. The price reverted to the January 1980 level in April 1981, but remained higher than the February 1979 level.

The 1980 hike in international gold prices followed world events, in particular, the Soviet intervention in Afghanistan in December 1979 and the contemporaneous rise of Khomeini to power in Iran, both of which led to strong oil prices and inflation. These events were exogenous to and unanticipated by Indian households. India imports almost all of its gold, so Indian consumers experience world price shocks.

One might be concerned that our analysis of monthly time series data for 1970-2005 might produce spurious results on account of common trends. To avoid this potential problem, we conduct a trend-cycle decomposition using the Hodrick-Prescott filter. Figure 3 show considerable month to month variation around the trend. A one standard deviation change in gold prices in this sample is 4.6 percent (See Appendix Table A.2).

It is estimated that 70 to 90 percent of households give dowry in marriage and that close to 95 percent of those who give dowry report giving gold[6]. Jewellery constitutes a large share of India's

[6]See the Survey of the Status of Women and Fertility (SWAF) 1993-94 (Smith et al. (2000)) and also data from the Human Development Profile of India 1994 (Desai et al. (2007)) and The World Gold Council report (World

aggregate gold demand, and although this share declined from 97% during the 1980s to 84.5% during the 1990s and 78% during 2000-05, it remains high (Kannan and Sarat (2008), Munshi (2011)). Aggregate gold consumption in India grew at a trend rate of 10.5% during 1980-2005, more than twice the rate of growth of global gold demand, at 4.5%.

Dowry has been in the news for instigating dowry deaths among married women in connection with the groom and his family attempting to extort higher dowry payments, and dowry deaths are likely to be the tip of an iceberg of domestic violence against women (Rocca et al. (2009), Bloch and Rao (2002)), the prevalence of which is estimated at 39 percent (Kishor and Gupta (2009))[7]. However, empirical research on dowry is scarce in general (though see Bloch and Rao (2002), Sekhri and Storeygard (2014)) and, in particular there appears to be no work dedicated to analysing impacts of the institution on son preferring behaviours[8].

2.2 Son Preference- Mechanisms

A vast literature documents the various ways in which Indian (and, in particular, Hindu) families exercise their preference for sons, for instance, through differential fertility stopping (Bhalotra and van Soest (2008)), female foeticide (Jha et al. (2006), Bhalotra and Cochrane (2010)), and gender-differentiated parental investments in antenatal care, breastfeeding, nutrition and immunization (Bharadwaj and Lakdawala (2013), Jayachandran and Kuziemko (2011), Chakravarty (2010), Oster (2009)). This sort of relative neglect of girls can lead to excess mortality, especially among very young children, because infectious disease is rife and young children are especially prone to contract infections with their nascent immune systems. Neonatal and infant mortality are therefore often used as markers of parental investments. Insofar as other determinants of mortality do not

Gold Council (2002)). That gold is integral to dowry is also evident in media coverage (Srivastava (2012), Jadhav (2015)) and in the academic literature (Rao (1993), Srinivasan (2005), Jejeebhoy and Sathar (2001)). Further discussion of dowry is in Section 9

[7] See, for instance, a 2014 news item at http://www.bbc.co.uk/news/world-asia-india-29127425

[8] A recent review states that “evidence on the impacts of the dowry system on womens welfare is mostly anecdotal”(Jayachandran (2014)). In its 426 pages, the World Development Report on Gender (The World Bank (2012)) makes limited reference to dowry and, where it does, it only discusses whether increasing economic opportunities for women leads to lower dowry. It has a substantial discussion of missing girls but this discussion makes no reference to dowry

discriminate between boys and girls, the girl-boy mortality differential will tend to mirror gender differentiation in investments.

While parental neglect will elevate mortality among the more vulnerable neonates and infants, the more robust will survive it, and we expect that survivors will be shorter, given research indicating that nutrition and disease-prevention in the first years of life influence adult stature, so height proxies for cumulative health status. (Bozzoli et al. (2009)). So, finding that girls exposed to the price hike are shorter in adulthood would ratify the proposed mechanism whereby parents neglect the management of nutrition and infections for girls born when gold prices are high.

The phenomenon of India's missing girls appears to be getting worse in the last two decades despite strong economic growth (Kohli (2006)), fertility decline (Foster and Rosenzweig (2006), Bhalotra and van Soest (2008)), and narrowing gender gaps in education (Deolalikar (2007), The World Bank (2012)). One reason for the rising trend is that the introduction of prenatal sex detection technology has made it easier to manipulate the sex ratio of surviving children.[9] Families that conceive because they want a son but not a daughter can now detect the sex of the foetus and conduct sex-selective abortion. Street advertisements in India encourage families to seek sex-selective abortion to avoid dowry costs. For instance, Desai (1994) reports that abortion clinics in Mumbai had posters with slogans such as "Better pay Rs 500 now than Rs 50,000 later". The Rs 500 is the cost of abortion and the Rs 50,000 refers to the future cost of dowry. Even if the incentive to 'eliminate' girls were unchanged, the availability of ultrasound scanners and, alongside, cheap (and often unsafe) abortion clinics has lowered the (financial and pyschic) cost.

Consistent with this, Anukriti et al. (2015) show that, after the introduction of ultrasound, postnatal excess girl mortality declined sharply, with the gap virtually closing for post-neonatal mortality. This suggests a substitution of the decisive act of sex-selective abortion for postnatal

[9] Bhalotra and Cochrane (2010) show that the timing of, initially the first imports and, later, the licensing of local production of ultrasound scanners lines up with a deviation of the sex ratio at birth from the normal range, in particular for second and higher order births in Hindu families with first-born daughters. These changes followed import liberalization and the deregulation of industrial licensing and were, as it happens, part and parcel of the process that fuelled India's transition into high growth. The authors estimate that as many as 0.48 million girls p.a. were selectively aborted during 1995-2005, more than the number of girls born in the UK each year. The authors also show that female foeticide is more likely in wealthier families and families in which the woman is relatively well-educated, most likely because desired fertility is lower in these families. As discussed earlier, wealthy, educated and high caste families also incur higher dowry costs.

neglect, which is a more indirect and hence more inconclusive way of manipulating the sex ratio of births. We shall split the time series sample into a pre and post-ultrasound period to investigate whether gold prices also motivated prenatal mortality in the post- period. This can happen either through abortion or through reduced antenatal care once the sex of the child is revealed to be female.

3 Empirical Strategy

3.1 Regression Discontinuity

Our hypothesis is that a rise in gold prices is perceived as an increase in the cost of dowry, which raises the cost of having a daughter relative to a son. A simple model is sketched in the Appendix. We first test whether this raises a commonly used index of son preference, which is the ratio of surviving boys to girls. We estimate a regression discontinuity (RD) specification of the form:

$$\begin{aligned} y_i &= \alpha + \beta t_i + \gamma f_i + \delta(t_i \times f_i) + g\left(f_i, x_i\right) + \varepsilon_i \\ \forall x_i &\in (c-h, c+h) \end{aligned} \tag{1}$$

where y_i is the outcome, t_i is the treatment, x_i is the forcing variable, f_i is a dummy variable equal to one if child i is a girl and h is a neighborhood around c, referred to as the bandwidth.

Treatment status (exposure to the gold price shock in the birth month) is a deterministic and discontinuous function of birth month, and we assume that the assignment of month of birth around the threshold is as good as random. Since gold prices peaked in February 1980, we define t_i as 1 for children born in and after March 1980 and 0 for children born before. We interact the treatment indicator and the running variable with the gender of the child to estimate a difference-in-discontinuities model. The assumptions of this model are milder than those required for a cross-sectional RD design or for a difference-in-differences strategy; see Grembi et al. (2011), who derive the identifying assumptions under which this estimator can identify different types of average treatment effects in the neighborhood of the population threshold. The parameter β

provides the causal effect of the gold price hike on boy mortality while δ is the differential effect on girl mortality. The outcomes we model are neonatal and infant mortality [10]. For the reasons discussed above, we also model the adult height of surviving girls born in and around March 1980. Standard errors are clustered by month-year of birth to allow for specification error in the forcing variable, following Card and Lee (2008).

In the rest of this section, we discuss tests of validity of the RD strategy, namely, robustness to alternative ways of controlling for the running variable, and tests on whether covariates exhibit a discontinuity at the point of the gold price shock. We describe a placebo designed to test the concern that we identify a birth month (or season) effect rather than a gold price effect. We know of no coincident events but we allow that a drought and an oil price shock preceding the gold price hike may have had lagged effects. Finally, we discuss how we investigate heterogeneity in the relationship by relevant sub-groups of the population with a view to raising our confidence in interpretation of the mechanisms at play.

3.1.1 RD Validity

As there is no value of x_i at which we observe both treatment and control observations, the method relies upon extrapolation across covariate values and, for this reason, we cannot be agnostic about regression functional form in RD (Imbens and Lemiuex (2008)). The control function $g(f_i, x_i)$ is some continuous function, usually an n-order polynomial, in the forcing variable x_i interacted with f_i on each side of c. Previous research has used variations of equation (1) with different bandwidths and control functions. We use local linear regression (Hahn et al. (2001), Imbens and Lemiuex (2008)), estimating the optimal bandwidth following Calonico et al. (2014). We test robustness to alternative specifications which vary the bandwidth and use quadratic polynomials for $g(x_i)$); see Gelman and Imbens (2014).

[10]As neonatal mortality risk is fully resolved in a month, it is readily matched to the monthly gold price. We also model infant mortality as a function of gold prices in the birth month because parents' treatment of children in the first month of life may result in mortality after the first month of life. For instance, under-nutrition in the first month may be compounded by infection in subsequent months. In any case, about two-thirds of infant mortality occurs in the neonatal period.

The identifying assumption for RD is that all other determinants of the outcome (other than the gold price) are continuously related to the running variable (birth month). We therefore test for balance around the March 1980 threshold of a range of relevant covariates, namely, birth order, whether the first child in the family is a son or daughter, caste, education of mother and father, and age of mother at first birth. With neonatal and infant mortality as outcomes, we must, in general, consider the possibility of endogenous heterogeneity in the composition of births created by differential fertility responses to gold price shocks. However, since we model a discontinuity in birth month effects, the optimal bandwidth is less than nine months, and it takes about nine months for fertility decisions to take effect. Compositional effects may also arise from socioeconomic differentials in prenatal sex detection (shown in Bhalotra and Cochrane (2010)), but this technology was unavailable in India in 1980 (Section 2), so the gold price hike cannot have stimulated sex-selective abortion or prenatal neglect of the girl child (Bharadwaj and Lakdawala (2013)). In any case, the balance tests will indicate any significant changes in the composition of births by observed covariates.

Since the RD analysis essentially models a break in excess girl mortality in March of 1980 relative to immediately preceding months, we implemented RD on the March of a series of preceding years to test the concern that excess girl mortality is seasonal and, in particular, rises in March of every year.

Adverse rainfall shocks have been previously associated with childhood mortality (Rose (1999), Deolalikar (2007), Bhalotra (2012)). While there is no evidence that rainfall shocks are in general correlated with gold prices, we were concerned that, if omitted, the effects of a major drought that struck India in 1979-1980 may load onto the March 1980 treatment indicator (see Figure A.1). For this reason, we control for twelve (monthly) lags of rainfall shocks (also including interactions of each shock variable with the female child dummy f_i). We construct shocks as the deviation of rainfall in the month of birth of child i from mean rainfall over the past 20 years in the state-month. We also control for food prices interacted with a gender dummy. Since the gold price hike was led by an oil price surge, we control for oil prices, interacted with a gender dummy. With monthly variation in potentially correlated prices held constant, we can more confidently associate

March 1980 with the gold price hike (although see Figure A.2). As a further check on this, we will discuss a time series specification in which we directly use gold price data. And, as a further check against the concern that we estimate the impact of oil and not gold prices, we obtain RD estimates of the impact of the 1979 oil price shock on excess girl mortality.

3.1.2 Heterogeneity

Even if March 1980 indicates the gold price hike and nothing else, the evidence would be more compelling if we could demonstrate that sub-groups where we would expect stronger responses are the sub-groups driving the average effects. This would also undermine any concerns about omitted variables or coincident events as they would have to exhibit the same heterogeneity in impact as the outcomes we model. We therefore re-estimate the equation on samples selected as discussed below.

First, we exploit the historic geographic divide in the status of women in India (Sen (2003)), which is reflected in population sex ratios (see Sen (1992), Bhalotra and Cochrane (2010), Jayachandran and Kuziemko (2011)) which vary for instance from 861 in the state of Haryana in the North to 1058 in Kerala in the South (these are numbers of women per 1000 men). Quoting Sen (2003), "A remarkable division seems to run right across India, splitting the country into two nearly contiguous halves, with missing women in the North and West but not in the South and East of the country." A historical literature similarly reveals that dowry has a longer history in the north-western states, where patrilocality is more common. We therefore split the all-India sample into states with population sex ratios above and below the median respectively.

Second, we split the sample into Hindu and non-Hindu households. Dowry in India originated in the Hindu community (Botticini and Siow (2003), Gupta (2002)). The non-Hindu group is dominated by Muslims, who have historically had bride-price and, although dowry has seeped into the practices of Muslim and other religious groups in India (Srinivas (1984), Waheed (2009)), the tradition remains stronger among Hindus (Borooah and Iyer (2004), Bloch et al. (2004)). So this sample split strengthens our attribution of the estimated impacts of gold prices to dowry.

Moreover, Muslims and Christians do not tend to manipulate the sex composition of their births through selective mortality, but instead, through continued fertility.[11]

Third, we differentiate responses by the sex of the first born child in view of evidence that female foeticide and excess mortality are both smaller in households with first-born sons, consistent with these households having attained a son early in the fertility cycle (Bhalotra and Cochrane (2010), Rosenblum (2013)). Given that the sex of first births is random (not manipulated), this provides quasi-experimental variation in the propensity to exercise son preference in response to gold price changes. In a related exercise, we investigate heterogeneity in response by the number of brothers and sisters of the index child since the financial strain of dowry is increasing in the number of daughters and decreasing in the number of sons. Finding larger impacts of gold prices in families with first born girls (and many girls relative to boys) will reinforce interpretation of the mechanisms that lead to lower survival rates of girls relative to boys as driven by son preference (rather than something else like income).

3.2 Time Series

We complement the RD approach with a time series analysis for three reasons: first, to explore external validity of the RD results; second and related, to investigate whether behaviour responds to smaller price shocks; and, third, so as to directly introduce gold prices into the analysis (in the RD analysis, treatment is identified by birth month and not by prices). The estimation sample is enlarged from a neighbourhood of a few months on either side of March 1980 to 420 months in the period 1970-2005.

Although the trend in the world gold price is plausibly exogenous to the evolution of girl relative to boy mortality in India, the two may be associated on account of omitted trends. We therefore use the Hodrick-Prescott filter with a smoothing parameter of 500 to construct a trend-cycle decomposition (see for instance Van Den Berg et al. (2006)). We test whether cyclical variation

[11] See, for instance, Bhalotra et al. (2010) who show that Muslims have better child survival rates in India conditional upon relevant covariates, and smaller gender gaps in child survival, Bhalotra and Cochrane (2010) who show that Hindus do and Muslims do not conduct female foeticide, and Almond et al. (2013) who document this difference in behaviour between Indian (mostly Hindu) and Pakistani (mostly Muslim) immigrants in Canada.

in gold prices modifies the extent of excess girl mortality using the equation

$$y_{itm} \quad = \quad \alpha + \beta \cdot (cyc_{tm} \times f_i) + \gamma \cdot (trend_{tm} \times f_i) + \eta^{(\prime} Z_{tm} \times f_i) + \delta' X_{itm} + \theta_t + \kappa_m + \varepsilon_{it} \quad (2)$$

where y_{itm} is the outcome of interest for individual i born in month m in year t, cyc_{tm} is the cyclical component, and $trend_{tm}$ the trend in gold prices in the month and year of birth tm, X_{itm} contains the un-interacted f_i, cyc_{tm}, and $trend_{tm}$ terms and individual controls mentioned in the previous section, Z_{tm} are the time-series controls motivated in the preceding section (rainfall shocks, rice and oil prices), and $theta_t$ and κ_m are year and month of birth fixed effects respectively. In what becomes a very harsh test of our hypothesis, we also include month $\times$ year of birth fixed effects. While these are collinear with the monthly deviation in the gold price, their differential impact on girl mortality is still identified.

As discussed in the preceding section, we do not expect endogenous fertility to matter when we consider month-specific shocks. Still, on the grounds that by far the majority of Indians have at least two children, we restrict the sample to second births (and the results are similar if we use all births)[12]. We initially report results for the entire sample. We then split it into a pre-1985 period when the average Indian had no access to prenatal sex detection, and a post-1985 period during which access began and became widespread. We introduce the sex ratio at birth as a new dependent variable (see Section 2), with the expectation that gold prices modify the sex ratio at birth post-1985 and not before; indeed the pre-1985 sample provides a placebo test. Since the major price hike of 1980 may dominate the pre-1985 sample, we re-estimate results on this sample removing the year 1980 to see if smaller shocks create behaviours similar to those created by the big shock. [13]

[12]In the pooled NFHS sample only 5.5 percent of women over 35 had just one child.

[13]When the outcome is the sex ratio at birth, the girl-boy differential is implicit i.e. it is incorporated in the dependent variable, and so the independent variable of interest is simply the monthly cyclical component of the gold price (i.e. there is no explicit interaction with a girl child indicator). Therefore this specification cannot accommodate month $\times$ birth year fixed effects.

3.3 Auxiliary Tests

We next investigate the time series properties of gold prices, and the relationship between gold prices and dowry payments.

3.3.1 Gold Prices- A Random Walk

If gold prices follow a random walk like many commodity prices (Deaton and Laroque (1992)), then a change is an innovation, and the rational expectation at any time is the static expectation. In this case, even if gold prices revert, when they rise then parents may expect prices to remain high and their behaviour is guided by current prices. In other words parents of girls act rationally when they perceive a gold price rise in the birth month as implying an increase in the financial burden of dowry, even if this is transacted some two decades later when the newborn is of marriageable age. We therefore test whether gold prices follow a random walk. For greater confidence in our findings, we present two tests, varying the null.

We first run the Augmented Dickey-Fuller test (ADF) for gold prices p_t using the model

$$p_t = \alpha + \delta t + \phi p_{t-1} + \epsilon_t \tag{3}$$

where $\alpha = \sum_{k=1}^{t-1} \epsilon_k$ is a drift constant term, and t is a linear trend. If p_t follows a random walk, we should fail to reject the null hypothesis of a unit root, $H_0 : \phi = 1$. We perform the DF-GLS version of the test proposed in Elliott et al. (1996), which is a modified version of the ADF performed on a GLS detrended series of p_t that has greater power with a finite sample size. We additionally perform a KPSS test for gold price stationarity using the model:

$$p_t = \boldsymbol{\beta}'\boldsymbol{D}_t + \mu_t + u_t \tag{4}$$

$$\mu_t = \mu_{t-1} + \epsilon_t, \quad \epsilon_t \backsim WN(0, \sigma_\epsilon^2) \tag{5}$$

where $\boldsymbol{D}_t$ contains a constant and a linear time trend in t, and u_t is trend stationary, or $I(0)$, and allowed to be heteroskedastic. μ_t is a random walk with innovation variance σ_ϵ^2. The null hypothesis in this test is that gold prices are trend stationary, or $H_0 : \sigma_\epsilon^2 = 0$ which implies that

μ_t is a constant. Failure to reject H_0 would indicate that gold price evolution over time is a mean-reverting process, rather than a random walk. In both the DF-GLS and KPSS tests, we allow for the optimal number of lags in p_t as determined by the criterion proposed in Schwert (1989) to be included in the specifications.

3.3.2 Gold Prices and Dowry Value

We have argued that the reason that an unexpected gold price rise magnifies excess female mortality is that parents perceive it as raising the financial burden of dowry. While it is clear that dowry contains gold (Section 2), we could find no systematic evidence of the gold price elasticity of dowry value. We therefore estimate this, modelling the value of dowry payments made in the year of marriage t for daughter i born in year b as a function of gold prices in her year of marriage and her year of birth. The estimated equation is

$$d_{itb} = \alpha + \beta \cdot cyc_t + \gamma \cdot cyc_b + \delta' X_i + \eta' Z_t + \varepsilon_{itb} \quad (6)$$

where d_{itb} is the logarithm of dowry value paid by bride i's family in year t, cyc_t and cyc_b are the cyclical components of gold price shocks in the marriage year and birth year respectively, and we control for the trend components of gold prices and for relevant couple characteristics X_i including caste and years of schooling of bride and groom and age of the bride at marriage. We also introduce time-series controls Z_t including rainfall shocks, rice prices and oil prices. Our expectation is that dowry value rises proportionately with contemporary gold prices and that conditional upon these it does not react to birth year prices.

4 Data and Descriptive Statistics

Individual data on neonatal and infant mortality rates for births in the period 1970-2005 are extracted from the three rounds of the National Family Health Survey of India (NFHS) conducted in 1992-3, 1998-9, and 2005-06 (see Bhalotra et al. (2010) for details of the survey and the construction of the child mortality data). The survey interviews women aged 15-49 (13-49 in NFHS-1) to obtain complete fertility histories, including the dates of all live births and of any child deaths. The data provide information on relevant covariates including birth order and caste, religion and education of parents. Data on (deflated) international gold prices from the World Gold Council are merged into the birth file by birth month and year. We use the 1999 wave of the Rural Economic and Demographic Survey (REDS) to obtain information on the monetary value of dowry payments. These are reported by the household head for all daughters, along with the year of marriage.[14] The year of marriage for the daughters who marry in these data ranges between 1969 and 1999 and their year of birth from 1944 to 1997.

Monthly oil and rice price data are from the World Bank. Monthly rainfall data are from the Palmer Drought Severity Index (PDSI) compiled by the National Center for Atmospheric Research (see Dai et al. (2004) for details). The PDSI records the amount of rainfall within areas sectioned as 2.5 degrees in longitude and 2.5 degrees in latitude. We constructed month and state averages of the PDSI and merged them with the individual mortality data by month and state. All prices are deflated using the US consumer price index (CPI) because they are international prices in dollars, and dowry values are deflated using the Indian CPI estimated by the Government of India for the class of agricultural laborers. Our estimates are not sensitive to the choice of deflator.

Summary statistics are in Table A.1. The RD sample consists of the optimal bandwidth of five to seven months on each side March 1980. In this restricted sample, the neonatal mortality rate is 6.2 percent and the infant mortality rate is 9.9 percent. Mortality rates are higher in Hindu relative to non-Hindu (largely Muslim) households.[15] Neonatal mortality is higher for boys than for girls, in line with a literature that documents the biological disadvantage of boys relative to girls in the first months of life (e.g. Waldron (1983)). Infant mortality, almost two-thirds of which is neonatal, is higher for boys in Muslim households but in Hindu households the initial advantage of girls is dissipated by the age of twelve months, consistent with the documented tendency for Hindus to invest more in boys than in girls in the early years. Descriptive statistics for the time series sample are in Table A.2, which also shows that the standard deviation of the

[14]The data are available from Andrew foster's website: *http://adfdell.pstc.brown.edu/arisreds_data/*.

[15]Bhalotra et al. (2010) document and analyze this gap in child mortality rates between Hindus and Muslims in India.

cyclical component of gold prices was 4.6% during 1970-2005, and smaller in the post-1985 than in the pre-1985 sample, though this is no doubt influenced by the massive price hike of 1980 falling into the pre-1985 period.

5 RD Results: Survival

5.1 Main Results

Estimates of specification (1) for neonatal mortality are in Table 1 and the corresponding estimates for infant mortality are in Appendix Table B.1. The optimal bandwidth for neonatal mortality, selected using the CCT algorithm cited earlier, is 6 (7) months around the threshold date for neonatal mortality in the Hindu (Non-Hindu) samples. For infant mortality, it is 5 and 7 months respectively. We show estimates with and without covariates. In both cases, there is a significant discontinuous increase in the risk of girls dying relative to boys from March 1980. For neonates, this is a differential of 2.3 to 2.7 percentage points, which is large relative to the average neonatal mortality rate in the RD sample of 6.2 percent. The corresponding jump for infant mortality is 5 to 6 percentage points.[16]

It is notable that the gold price hike is associated with a *decline* in mortality for boys. This is consistent with gold prices increasing the benefit of receiving dowries for families with boys in Hindu families, and with investments in boys benefiting from increased neglect of girls. Our findings do not necessarily imply that parents attach greater weight to the welfare of sons, only that dowry raises the cost of having daughters. Since many of the potential omitted variables are likely to be common to boy and girl mortality rates, our finding that gold prices move girl and boy mortality rates in opposite directions undermines the role of omitted variables. It also makes it unlikely that there is any substantial negative income effect of gold price increases, rather, the results are consistent with substitution effects of a relative price change.

[16] The larger coefficient estimates for infant mortality indicate that over and above excess girl neonatal mortality, there is excess girl mortality between the second and twelfth month of life. This may be the result of parental behaviours (neglect) initiated in the birth month or continuing after the birth month, or both.

Figure 4 provides a graphical illustration of the RD results.[17] The mortality rate in annual bins is plotted against birth-month with a cutoff in March 1980. Overlaid is a local linear smoother on each side of the discontinuity. The graphs demonstrate a significant jump in girl relative to boy mortality for girls in Hindu families.

5.2 Validity and Robustness Checks

In this section, we report checks designed to ensure that the estimates from the local linear RD are valid and robust. First, we test robustness to specification of the running variable (birth month) to ensure that the jump we identify around the threshold is due to the change in gold prices and not an underlying (nonlinear) trend in birth month. We estimated the specification in equation 1 using a bandwidth of 4 months, narrower than the optimal bandwidth given by the CCT algorithm in Panel A of Table A.4. We also included a quadratic control function in birth month in the equation, with the results in Panel B of the same table. The estimates are robust to these variations; we cannot reject the null of equal coefficient estimates for the parameters of interest.

In order to ensure that the jump in March 1980 is not just a seasonal tendency for elevated girl relative to boy mortality in the month of March, we implemented a placebo test, shifting the threshold date to March of each of the preceding three years, back to March 1977. See Figure 7, which presents the point estimates with 95 percent confidence intervals. The coefficients on the placebo thresholds are always smaller and in no case are they statistically significant. So, one might say, pre-trends in the outcome were not significantly different for March versus preceding months.

We tested for balance on relevant covariates listed in Section 3, plotting monthly bin averages against birth month separately for girls and boys; see Figures 5 and 6. The covariates appear balanced around the threshold but we tested this formally following Lee and Lemieux (2010) and found that there is no individually significant jump at the threshold at conventional signifi-

[17] Figure B.1 plots the same relationship for infant mortality rates.

cance levels and, using seemingly unrelated regressions (SUR), we reject the joint significance of treatment on the covariates (Results are provided in Appendix Table A.3).

The estimates in Table 1 are conditional upon rainfall shocks. In Table A.8, we introduce monthly rice and oil prices as additional controls. The point estimates are robust to this, although they lose precision when we include oil prices. Howerver, we will see below that when we use the larger time series sample where we have more statistical power, precision in this specification is restored. Still, to more definitively rule out the possibility that our findings are driven by an oil price hike, we estimate the RD specification in equation 1 using the oil price hike (June 1979) as the threshold date. Table 5 shows that the oil price shock did not raise excess girl mortality in Hindu households.

5.3 Heterogeneity

In this section, we report results of estimating the coefficient of interest for particular population sub-groups. This was motivated in Section 3. Disaggregation of the sample into Hindu and non-Hindu families in Table 2 shows that the marginal effect of the gold price hike on excess girl mortality emerges from the Hindu sample. The gold price hike is estimated to have led to an increase of 4.3 percentage points in neonatal mortality rates of girls relative to boys, while there was no excess mortality among non-Hindu girls (in fact the point estimate suggests that non-Hindu girls did better than boys post-March 1980, although the differential is not statistically significant).

Splitting the sample into states with population sex ratios (females to males) below versus above the median level, we find that excess girl mortality in Hindu households is only evident in states with more male-biased ratios, which are the states known to have historically entrenched gender prejudice. The gold price hike is associated with a 7.2 percentage point increase in the girl-boy differential in neonatal mortality in this group.[18]

[18] Replacing the population sex ratio with the male-female literacy gap as an alternative but possibly less pre-determined measure of the extent of gender bias in society produces a similar pattern of results: see Appendix Table A.5.

On the premise that the sex of the first born child is random and that families with first born daughters tend to continue fertility and/or to commit more sex-selective abortion than families with first born sons (see Section 3), we introduced an interaction of the treatment indicator with this variable. The variable of interest is the triple interaction term "treatment × girl × first-born male", where "treatment", as before, is an indicator for birth in or after March 1980, and the equation includes the double interactions and the main effects. See Table 3. We find that the gold price shock creates excess girl neonatal mortality of about 6 percentage points among Hindu households in which the first-born child is a daughter but it creates effectively *no* excess neonatal girl mortality where the first born is a son.[19] We repeated the analysis, replacing the indicator for first-born son with two terms, the number of older brothers and the number of older sisters of the index child. These variables are less clearly exogenous but they should have more power as, when gold prices rise, the dowry burden perceived by parents will be increasing in the number of daughters and decreasing in the number of sons. The results, in Appendix Table A.6, show that excess girl mortality is significantly increasing in the number of sisters in the household.

We also investigated heterogeneity in treatment effects by caste. The practice of dowry and the exercise of son preference are both historically more common among the higher castes (Tambiah and Goody (1973), Dreze and Sen (1995), Bhalotra and Cochrane (2010)) but low caste households are poorer and more likely to be financially constrained in the face of a shock, so the predictions are ambiguous. The results are in Table A.7, panel A. The point estimates for excess girl neonatal mortality are statistically significant for both caste groups, larger in the low caste sample but not statistically significantly different from the estimates for the high caste sample.

Overall, the finding that the reduction in girls' relative survival chances following the gold price hike is larger in regions and in households that have a stronger tradition of dowry and/or a greater historic willingness to manipulate the sex composition of surviving births is consistent with our contention that conscious parental neglect of girl children in reaction to a perceived increase in dowry costs is the driving mechanism.

[19] In the case of infant mortality, the gold price shock creates excess girl mortality irrespective of first born sex, but the differential is still significantly larger in families with a first born daughter: 10.9 vs 5 percentage points.

6 RD Results: Stature

For reasons discussed in Section 3, we use the RD design on birth month to test whether girls born in or after March 1980 who survive until early adulthood are shorter than girls born in the preceding few months. The results are in Table 4. Overall, women exposed to the gold price hike in their birth month are a significant 0.49 centimeters shorter. In line with the survival results, this is only true among Hindu women, for whom the height differential is 0.72 cm. The estimates are robust to the controls described for the survival equations. These findings suggest that the increase in the cost of having a daughter induced by the gold price hike led to lower health investments in girls, which had persistent effects on survivors.[20].

Height has been linked to life expectancy, cognitive performance and socioeconomic status (Thomas and Strauss (1997), Strauss and Thomas (2007), Waaler (1984), Fogel (2004)) and also to the health and survival of a woman's offspring (Bhalotra and Rawlings (2011)). Using the third round of the National Family Health Survey, we find that taller women are more educated, marry later, and are less likely to experience domestic violence. These associations (available on request) are not causal, but they suggest that girls exposed to the gold price height had worse health and socioeconomic outcomes.

7 Time Series Results: Prenatal and Postnatal Survival

7.1 Postnatal Survival

To complement the RD on birth month, we estimated the girl-boy differential in survival as a function of cyclical variation in gold prices using HP-filtered monthly time series data for 1970-2005. The results are in Table 6. The pattern of results is the same as obtained using RD. A one standard deviation increase in (filtered) gold prices (4.6 percent), estimated on month on month variation around a trend leads to a 0.2 percentage point increase in the neonatal mortality risk of girls relative to boys in their birth month.

[20] The point estimates are similar for high and low castes, although more precisely determined for lower castes; see Appendix Table A.7, panel B.

These coefficients are robust to introducing controls for caste, rainfall shocks, state fixed effects, linear and quadratic state-specific time trends and rice and oil prices (interacted with a girl child indicator). In the final column of the Table we add month-and-year of birth fixed effects. Since gold prices vary by month and year, the main effect (on boys) is no longer identified, but the differential effect on girls is. It remains positive but falls from 0.055 to 0.038. However, once we restrict to the Hindu sample where the action is, the magnitude and significance of this coefficient is remarkably robust to this most demanding specification; see Table 7. A one s.d. change creates a differential 0.3 percentage point increase in excess neonatal girl mortality in Hindu households, while having no impact in non-Hindu communities.[21]

One of the advantages of the time series approach is that it tests the external validity of the RD result. To be sure that the time series results are not driven by the March 1980 hike, we re-estimated the equation excluding from the sample children born six months before or after March 1980. The estimated effect of gold prices on excess girl mortality is slightly larger though not significantly so, see Table A.11.

7.2 Prenatal Survival

As discussed in sections 2 and 3, we split the time series sample into a pre-ultrasound period, 1970-1985 and a post-ultrasound period, 1986-2005, and estimate impacts of gold price variation on the sex ratio at birth, which reflects gender differences in foetal mortality. We continue to model neonatal and infant mortality and expect that the impact of gold prices on these postnatal outcomes is larger in the pre-1985 sample, diminishing among post-1985 cohorts if gold price motivated fetal mortality substitutes postnatal mortality (Anukriti et al. (2015)). Based upon our finding that girl neonatal mortality responds to gold prices only in Hindu households, and the finding reported in Bhalotra and Cochrane (2010) that sex-selective abortion is in general restricted

[21] We also estimated the equation by caste (Table A.10), and find that in contrast to the RD results, the point estimates are larger for high caste households, consistent with the evidence cited earlier that the practice of dowry and manipulation of the sex composition of births have both featured more prominently among high caste Hindus in the historical record. However, consistent with the RD results, the high and low caste coefficients are not significantly different. A reason that the relative magnitude of the caste group coefficients is different for RD and time series may be that these coefficients are changing over time. The time series incorporates both a much longer time frame and a period in which sex selection appears as an alternative mechanism for adjustment of the sex ratio of surviving children.

to Hindu households, we restrict the sample to Hindus. We expressed postnatal mortality as a function of gold prices in the birth month. Since the behaviours generating changes in the sex ratio (i.e. prenatal sex detection, and subsequent abortion) are conducted during pregnancy, we modeled the sex ratio at birth as a function of gold prices averaged over the third trimester of pregnancy.[22] Results are in Tables 8 and 9.

We find that it is only in the pre-ultrasound period that gold price changes result in changes in excess girl mortality. In the post-ultrasound period, gold price changes are instead reflected in changes in the sex ratio at birth. The placebo we outlined in section 3 is satisfied inasmuch as there is no variation in the sex ratio at birth with gold prices pre-1985.[23]

Pre-ultrasound, a one s.d. increase in the monthly-deviation of gold prices from trend (estimated on the entire time series sample, at 4.6 percent) resulted in a 0.6 percentage point increase in neonatal mortality. Post-ultrasound, it resulted in a decrease in the probability of a girl birth of 1.5 percentage points in families with a first-born daughter[24]. Since we estimate a coefficient not significantly different from zero for families with a first born son and these are roughly half of all families (the sex of the first born is quasi-random), this implies a 0.75 percentage point reduction in the overall probability of a (Hindu) girl birth. Given that the natural chances of a girl birth are close to half, this implies an additional 1.5 girl fetal deaths in 100 conceptions. So a crude estimate of the substitution of prenatal for postnatal mortality in response to gold price increases is that for every one neonatal girl death pre-1985, 2.5 (1.5/0.6) girl conceptions did not survive to birth in the post-1985 period. In this sense, gold prices are having an increasingly detrimental impact on the share of surviving girls.

[22] We experimented with alternative specifications. If we include gold prices in each of the three trimesters of pregnancy, it is only prices in the third trimester that are statistically significant. If we instead use gold prices in the birth month, to parallel the specification for mortality, we find a statistically significant coefficient that is about two-thirds as large as the coefficient we report, consistent with the birth month being part of the third trimester.

[23] While India has seen dowry inflation, aggregate gold demand in India is rising and gold remains an integral part of dowry, there is a tendency for consumer goods such as washing machines or refrigerators to be included in dowry since India's trade liberalization has improved access to these goods for a large fraction of the population (World Gold Council (2002)). It is relevant therefore to test whether this trend has eliminated or weakened the relevance of gold prices to dowry, but the results for the post-1985 period suggest not.

[24] This is about two-thirds of the total decline in the proportion of female births in this group after 1995 (and almost all the decline after 1985); see Table 2 of Bhalotra and Cochrane (2010)

8 Results: Auxiliary Tests

8.1 Time Series Properties of Gold Prices

The estimates in Table 11 indicate that gold prices follow a random walk. The estimates from the DF-GLS test in column (1) show that the null hypothesis $H_0 : \phi = 1$ is never rejected at the 5% level, with up to 17 lag terms included in the covariates when estimating equation (3). Conversely, the estimates from the KPSS test in column (3) show that the null hypothesis $H_0 : \sigma^2_\epsilon = 0$ is *always* rejected at the 5% level with up to 17 lags included when estimating (4).

Browning and Subramaniam (1995) show that parents start saving (for dowry) as soon as they receive the unexpected information that their birth is a girl, and they explain this in terms of consumption smoothing over the life-cycle. They do not consider the possibility that the cost of dowry will vary with gold prices so our purpose is distinct, but their results do underline that parents are forward looking and that parents of newborn girls are actively considering and accounting for the cost of dowry. That Indian families typically accumulate dowry over several years prior to the date of marriage is also documented in the World Gold Council Report (World Gold Council (2002)).

8.2 Gold Prices and Dowry Value

We find a robust positive relationship between gold prices in the year of marriage and the value of dowry payments (see Table 10), and this establishes that gold prices are a marker of the financial burden of dowry. The elasticity is not significantly different from unity (panel B), suggesting that values rise proportionately with prices or that the content (quantity and composition) of dowry does not adjust to the gold price, possibly because of sticky social norms regarding content. Conditional upon gold prices in the year of marriage, gold prices in the year of birth have no significant effect on the value of dowry[25]. These relationships are robust to controlling for characteristics of the couple, rice and oil prices, rainfall shocks, and state GDP. As discussed, gold in dowry is often in the form of jewellery, and there is anecdotal evidence that dowry may also include silver jew-

[25]The coefficient on gold prices in the birth year is not sensitive to whether prices in the year of marriage are included in the specification, suggesting that price deviations in these years are not correlated.

ellery. So it is plausible that when gold prices increase, people switch to silver jewellery. However the price of silver tracks the price of gold (see Figure A.3).

9 Discussion

In Section 3, we specified a number of checks that raise our confidence that we identify the impact of gold prices rather than of season, of omitted prices, or other omitted trends. The results provide fairly compelling evidence that gold price variation creates systematic variation in excess girl mortality, whether foetal or postnatal, and in the adult stature of surviving girls. We interpret gold price increases as raising the perceived financial burden of dowry, and the previous section presented evidence consistent with this. Here we first consider whether gold price variation might create the observed results without dowry being in the picture. We then discuss the natural question of whether the importance of dowry in Indian society will decline with economic development.

On the first question, to remove dowry from the picture, suppose that gold is only purchased for its consumption value, for instance, as an ornament for parents. Then a gold price increase will create a negative income effect for net purchasers of gold and it is conceivable that this lowers investments in boys and girls (especially in income-constrained households). If there is son preference (parents attach more weight to the welfare of sons than daughters), then the reduction in investments will be larger for girls and so, in principle, our results may appear without reference to dowry. In Appendix C we sketch a simple model illustrating this.[26]

While the straw-man model is an interesting curiosity, its relevance is limited to the extent that the median Indian household is poor and would probably not be a net purchaser of gold in the absence of dowry. Also, among net purchasers of gold, the share of gold in total annualized expenditure is likely to be small. In any case, a number of features of the evidence argue against income effects being the driving mechanism.

[26] We would like to thank Selma Telalagic for suggesting this model in her discussion of our paper at an Oxford seminar.

First, we find a consistent tendency for increases in gold price to reduce boy mortality, which is statistically significant in the RD estimates. This is consistent with sons bringing in dowry and inconsistent with a negative income shock. Second, oil and rice price increases will create stronger negative income effects than gold price increases given that fuel and food prices dominate the consumer price index. Our estimates show that any excess girl mortality flowing from oil and rice price increases is in the poorer non-Hindu communities; see Tables A.8 and A.9. Also see Table 5 where we use RD to estimate the effects of the 1979 oil price hike on excess girl mortality. On average, Muslims (and Christians) in India are poorer than Hindus and so one may expect them to react more to income shocks. But, as discussed, the response to gold prices that we document emerges from Hindu households, with non-Hindu households showing no increase in girl relative to boy mortality. Similarly, if income effects were the driving process, we may expect to see significantly larger responses among low caste households, but this is not what we find, and certainly not in the time series.

For households that hold stocks of gold, an increase in gold prices will create a positive wealth shock (and jewellery as collateral will rise in value). As this will tend to lower mortality for boys and girls, this cannot be driving our results- we not only see an increase in the girl-boy differential, but a tendency for the girl mortality rate to increase. Overall, the documented deterioration in the number of surviving girls relative to boys following gold price shocks does not appear to be a gender-differentiated income or wealth effect but, rather, a price effect that raises the cost of daughters relative to sons.

On the second question, we refer to theoretical research on the emergence and disappearance of dowry. In his seminal work, Becker (1981) modelled dowry and brideprice as monetary transfers that act to clear the marriage market (also see Rao (1993)), Bhaskar (2015)). Discussing the limitations of the Beckerian approach, Botticini and Siow (2003) model the emergence of dowry as a pre-mortem bequest to daughters alongside post-mortem inheritance rights of sons as incentivizing the effort of sons on family property. Their model suggests that the withering of the institution across most of the world can be explained by the decline of agriculture, rising human capital and intergenerational occupational mobility (also see Boserup (1970)). However, dowry has persisted in India despite sustained economic growth since the 1990s and a strong trend in women's education and despite the 1961 Dowry Prohibition Act. Although theory and evidence suggest that investment in girls' education may substitute dowry (Roy (2015)), the stylized facts indicate that dowry payments are increasing in girls' (and boys') education (Anderson (2007); Appendix Tables A.12 in this paper). The tradition that sons and only sons have the right to inherit ancestral property (and that daughters get dowry instead) was institutionalized in the Hindu Succession Act of 1957. Between 1976 and 1994, five Indian states amended this Act to grant property rights to women, and in 2005, a federal constitutional amendment resulted in a nationwide equalization of property rights for men and women. A number of recent studies use the quasi-experimental variation in the timing of this reform across states to identify its impacts on the status of women. While no study has focused upon dowry, the literature suggests that it resulted in increased intra-household conflict symptomized in suicides of men and women (Anderson and Genicot (2015)), and an intensified preference for having sons, evident in increased female foeticide (Bhalotra et al. (2015)), results which suggest that social norms in India militate against the potential for legal reform.

10 Conclusion

Exploiting a sharp shock of unprecedented magnitude to the world gold price in 1980, and validating our findings using monthly time series variation across 35 years, we provide what we believe is the first systematic evidence that the son-preferring behaviours of Indian parents respond to changes in the cost of dowry. The responses are large. They are activated not only after big shocks but also after smaller ones. Our findings implicate dowry as a substantial contributor to the phenomenon of missing girls. We also document significant impacts on survivors, showing that girls born during the gold price hike who survived to early adulthood were shorter, and we cite evidence that height is clustered with a range of positive socioeconomic outcomes in the long run.

Since adult stature is a function of childhood nutritional choices and foeticide is a deliberate act, this amounts to fairly compelling evidence that gold price variation motivates parental manipulation of the sex ratio of surviving children. We rationalize parents reacting to gold prices in the birth year in terms of the time series properties of gold prices. We consistently difference girl from boy outcomes, which eliminates a host of potential alternative explanations of our findings. We conduct a number of robustness checks. For instance, we show that the discontinuity in excess girl mortality evident in March 1980 is absent in the March of preceding years, and we show that the estimated impacts of gold price variation are not confounded by the effects of food or oil price shocks. We conduct several checks on our attribution of our findings to son preferring behaviours motivated by dowry. First, we show that dowry payments rise proportionally to gold prices. Second, we reject an income or wealth channel. Third, we show that the identified tendency for gold prices to motivate an intensification of son-preferring behaviours is most evident in those population sub-groups in which dowry is a stronger tradition.

A vast literature has documented that Indian parents practice differential fertility stopping, commit female foeticide, and invest more in sons. These practices generate a male-biased population sex ratio, and numerous studies have documented what is possibly India's greatest embarrassment, the vast and growing number of missing women and girls. In this way, the outcomes of son preference are well-established. Yet there is surprisingly limited evidence on the causes of son preference, which often appears as a primitive. This is no doubt because it can be hard to find variation in institutional factors. We averted this problem by studying variation in the perceived cost of dowry. Previous studies have attributed regional differences in son preference to time-invariant regional factors such as soil quality and crop choice that create variation in women's labour supply (Miller (1981), Carranza (2014)), and kinship systems that generate variation in how physically and economically distant daughters become from the natal home after marriage (Dyson and Moore (1983)). While these factors no doubt play a role, their impacts are hard to isolate from regional heterogeneity. By introducing gold prices into the analysis, we generate time variation that helps identification.

Although our primary contribution is to provide what we believe are the first estimates of the relevance of dowry costs to explaining the persistent problem of 'missing girls' in India, we also contribute to a literature on commodity price shocks and, more generally, the relationship between the macro-economy and intra-household resource allocation (Burgess and Zhuang (2000), Qian (2008), Deaton and Tarozzi (2000)).

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Table 1: RD- Neonatal Mortality: Gold Price Shock

	(1)	(2)	(3)	(4)
treatment	-0.000	-0.011	-0.015*	-0.029**
	(0.008)	(0.013)	(0.008)	(0.010)
girl		-0.027**		-0.025**
		(0.010)		(0.010)
treatment × girl		0.023*		0.027**
		(0.012)		(0.012)
Observations	12743	12743	12743	12743
Bandwidth	6	6	6	6
Covariates	No	No	Yes	Yes

Notes: RD is regression discontinuity. The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for Treatment. The covariates include birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the girl child indicator. Standard errors are clustered by month-year-cohort.

Table 2: RD- Neonatal Mortality: By Religion and Population Sex Ratio

	Full sample		Hindu sample		Non-Hindu sample	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: All States			
treatment	-0.015*	-0.029**	-0.016	-0.037**	-0.017	0.007
	(0.008)	(0.010)	(0.010)	(0.013)	(0.013)	(0.016)
girl		-0.025**		-0.034*		0.019
		(0.010)		(0.016)		(0.020)
treatment × girl		0.027**		0.043**		-0.047
		(0.012)		(0.018)		(0.027)
Observations	12743	12743	9948	9948	2795	2795
Bandwidth	6	6	6	6	6	6
			Panel B: States with Higher Gender Prejudice			
treatment	-0.009	-0.034	-0.017	-0.051	0.027	0.040
	(0.018)	(0.030)	(0.023)	(0.038)	(0.022)	(0.025)
girl		-0.031		-0.036		0.001
		(0.023)		(0.028)		(0.037)
treatment × girl		0.053		0.072*		-0.025
		(0.032)		(0.037)		(0.053)
Observations	7094	7094	5936	5936	1158	1158
Bandwidth	6	6	6	6	6	6
			Panel C: States with Lower Gender Prejudice			
treatment	-0.016	-0.023	-0.009	-0.031	-0.031*	0.006
	(0.010)	(0.015)	(0.013)	(0.018)	(0.015)	(0.021)
girl		-0.027**		-0.051**		0.028
		(0.010)		(0.023)		(0.032)
treatment × girl		0.013		0.044		-0.076
		(0.016)		(0.028)		(0.045)
Observations	5649	5649	4012	4012	1637	1637
Bandwidth	6	6	6	6	6	6

Notes: States with higher gender prejudice have a male-female sex ratio above the median, and those with lower gender prejudice have a male-female sex ratio below the median. The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment, a dummy variable for whether the eldest (first-born) sibling was a boy, and its interaction with Treatment dummy, birth order fixed effects, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the girl child indicator. Standard errors are clustered by month-year-cohort.

Table 3: RD- Neonatal Mortality: By Sex of the Firstborn Child

	Full sample			Hindu sample			Non-Hindu sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Panel A: No Covariates				
treatment	-0.000	-0.011	-0.032**	-0.001	-0.018	-0.033	-0.000	0.011	-0.027
	(0.008)	(0.013)	(0.014)	(0.009)	(0.016)	(0.019)	(0.010)	(0.015)	(0.034)
treatment × girl		0.023*	0.052***		0.036*	0.060**		-0.024	0.019
		(0.012)	(0.013)		(0.018)	(0.020)		(0.024)	(0.020)
treatment × first-born male			0.030**			0.020**			0.051
			(0.012)			(0.009)			(0.049)
treatment × girl × first-born male			-0.061***			-0.054***			-0.074
			(0.008)			(0.015)			(0.050)
Observations	12743	12743	12743	9948	9948	9948	2795	2795	2795
Bandwidth	6	6	6	6	6	6	6	6	6
					Panel B: With Covariates				
treatment	-0.015*	-0.029**	-0.050***	-0.016	-0.037**	-0.050**	-0.017	0.007	-0.040
	(0.008)	(0.010)	(0.013)	(0.010)	(0.013)	(0.016)	(0.013)	(0.016)	(0.035)
treatment × girl		0.027**	0.056***		0.043**	0.065***		-0.047	0.006
		(0.012)	(0.015)		(0.018)	(0.021)		(0.027)	(0.022)
treatment × first-born male			0.029**			0.018**			0.061
			(0.012)			(0.008)			(0.047)
treatment × girl × first-born male			-0.059***			-0.052**			-0.091*
			(0.008)			(0.018)			(0.048)
Observations	12743	12743	12743	9948	9948	9948	2795	2795	2795
Bandwidth	6	6	6	6	6	6	6	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment, a dummy variable for whether the eldest (first-born) sibling was a boy, and its interaction with the treatment dummy variable. In addition, all regressions in Panel B control for birth order fixed effects, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the girl child indicator. Standard errors are clustered by month-year-cohort.

Table 4: RD- Adult Height

	Full sample		Hindu sample		Non-Hindu sample	
	(1)	(2)	(3)	(4)	(5)	(6)
treatment	-0.347	-0.493*	-0.754**	-0.720*	0.296	-0.111
	(0.218)	(0.244)	(0.312)	(0.388)	(0.442)	(0.491)
Observations	3687	3687	2732	2732	955	955
Full Controls	No	Yes	No	Yes	No	Yes
Bandwidth	5	5	5	5	5	5

Notes: The dependent variable is height (in centimeters) of the female respondent in NFHS. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment and state fixed effects. In addition, regressions in columns (2), (4) and (6) control for high-caste indicator (for Hindu sample), the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month along its lags for the past 12 months. Standard errors are clustered by month-year-cohort.

Table 5: RD- Neonatal Mortality: Oil Price Shock

	Everyone		Hindus		Non-Hindus	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: No Covariates			
treatment	0.014	0.006	0.023	0.022	-0.020	-0.047
	(0.010)	(0.008)	(0.018)	(0.016)	(0.020)	(0.034)
girl		-0.035***		-0.020**		-0.077**
		(0.009)		(0.008)		(0.026)
treatment × girl		0.017		0.002		0.058*
		(0.016)		(0.016)		(0.031)
Observations	10181	10181	7816	7816	2365	2365
Bandwidth	6	6	6	6	6	6
			Panel B: With Covariates			
treatment	0.009	-0.004	0.018	0.012	-0.018	-0.033
	(0.009)	(0.006)	(0.016)	(0.014)	(0.017)	(0.022)
girl		-0.039***		-0.034***		-0.048***
		(0.008)		(0.009)		(0.013)
treatment × girl		0.027**		0.014		0.031*
		(0.012)		(0.012)		(0.016)
Observations	9846	9846	7518	7518	2328	2328
Bandwidth	6	6	6	6	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after June 1st 1979, 0 otherwise. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment, birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the girl child indicator. Standard errors are clustered by month-year-cohort.

Table 6: Time Series- Neonatal Mortality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gold price	-0.023	-0.021	-0.020	-0.020	-0.019	-0.022	
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	
gold price × girl	0.062**	0.060**	0.060**	0.060**	0.058**	0.055*	0.038*
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.022)
Observations	137434	137434	137434	137434	137434	137434	137434
Month of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes	Yes
Rice Price × Girl	No	No	No	No	Yes	Yes	Yes
Oil Price × Girl	No	No	No	No	No	Yes	Yes
Month × Year of birth fixed effects	No	No	No	No	No	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with "girl" dummy. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month,and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table 7: Time Series- Neonatal Mortality: By Religion

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Hindu Sample					
gold price	-0.026	-0.025	-0.024	-0.024	-0.029	
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	
gold price × girl	0.067**	0.066*	0.064*	0.065*	0.064*	0.064*
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Observations	103171	103171	103171	103171	103171	103171
	Panel B: Non-Hindu Sample					
gold price	-0.015	-0.010	-0.007	-0.008	0.002	
	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	
gold price × girl	0.049	0.044	0.046	0.044	0.019	0.017
	(0.051)	(0.051)	(0.051)	(0.051)	(0.052)	(0.052)
Observations	34263	34263	34263	34263	34263	34263
Month of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Month × Year of birth fixed effects	No	No	No	No	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table 8: Time Series- Neonatal Mortality and Sex Ratio at Birth Pre-Ultrasound

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Neonatal Mortality Before 1985					
gold price	-0.048	-0.050	-0.048	-0.053	-0.077**	
	(0.034)	(0.035)	(0.035)	(0.035)	(0.036)	
gold price × girl	0.093**	0.100**	0.100**	0.101**	0.135***	0.128***
	(0.045)	(0.046)	(0.046)	(0.046)	(0.048)	(0.048)
Observations	29651	29651	29651	29651	29651	29651
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes
	Panel B: Female Birth Before 1985					
gold price	-0.068	-0.047	-0.052	-0.041	-0.049	-0.109
	(0.082)	(0.086)	(0.087)	(0.088)	(0.093)	(0.114)
gold price × first son						0.178
						(0.133)
Observations	29651	29651	29651	29651	29651	29651
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices	No	No	No	No	Yes	Yes

Notes: The dependent variable in Panel A is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period, in Panel B it is a dummy variable equal to 1 if the child is a girl, 0 otherwise. Sample is limited to second-born Hindu children born during 1972-2005. In Panel A "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars *at the month of birth of the child*, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. In Panel B "gold price" refers to cyclical component of the detrended monthly gold price in US dollars *averaged over the month of birth and two months prior to birth of the child.* All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table 9: Time Series- Neonatal Mortality and Sex Ratio at Birth Post-Ultrasound

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Neonatal Mortality After 1985					
gold price	0.035	0.038	0.039	0.044	0.050	
	(0.044)	(0.044)	(0.044)	(0.044)	(0.046)	
gold price × girl	-0.057	-0.060	-0.058	-0.057	-0.068	-0.068
	(0.060)	(0.061)	(0.061)	(0.061)	(0.063)	(0.063)
Observations	73520	73520	73520	73520	73520	73520
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes
	Panel B: Female Birth After 1985					
gold price	-0.165	-0.196*	-0.200*	-0.197*	-0.231*	-0.329**
	(0.115)	(0.117)	(0.117)	(0.119)	(0.126)	(0.164)
gold price × first son						0.231
						(0.209)
Observations	73520	73520	73520	73520	73520	73520
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices	No	No	No	No	Yes	Yes

Notes: The dependent variable in Panel A is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period, in Panel B it is a dummy variable equal to 1 if the child is a girl, 0 otherwise. Sample is limited to second-born Hindu children born during 1972-2005. In Panel A "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars *at the month of birth of the child*, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. In Panel B "gold price" refers to cyclical component of the detrended monthly gold price in US dollars *averaged over the month of birth and two months prior to birth of the child.* All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table 10: Dowry Value and Gold Prices

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Log of Gold Price						
log gold price	0.443***	0.591***	1.554***	1.556***	1.508***	1.606***
	(0.104)	(0.174)	(0.269)	(0.450)	(0.369)	(0.481)
log gold price at birth					-0.025	0.043
					(0.125)	(0.136)
Observations	4201	4201	2239	2239	2239	2239
Panel B: Separating Trend and Cycle						
gold price	0.427***	0.690***	0.991**	1.322*	1.055**	1.330*
	(0.164)	(0.215)	(0.463)	(0.686)	(0.464)	(0.692)
gold price at birth					0.093	0.088
					(0.167)	(0.167)
Observations	4201	4201	2239	2239	2239	2239
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	No	Yes	No	Yes	No	Yes
Years in sample	1970-99	1970-99	1980-99	1980-99	1980-99	1980-99

Notes: Data is from the 1999 wave of the Rural Economic and Demographic Survey. The dependent variable is the log real value of dowry payment made by the bride's side to the groom's side at the time of marriage. Log gold price is the log of the average monthly gold price in the year of marriage. All monetary prices are deflated using Indian CPI from World Bank Development Indicators. All regressions control for state fixed effects, caste of the bride's family and caste of the groom's family, a dummy variable taking value 1 if the bride's family is Hindu, number of brothers of the bride, number of sisters of the bride, age of the bride at marriage age and its square, and years of schooling of the bride and groom. In addition, regressions in columns (2), (4) and (6) control for state GDP, state average rainfall, world rice price and world oil price (separated into cyclical and trend components in Panel B) in the year of marriage. Standard errors are clustered by household.

Table 11: Gold Prices - Random Walk Test

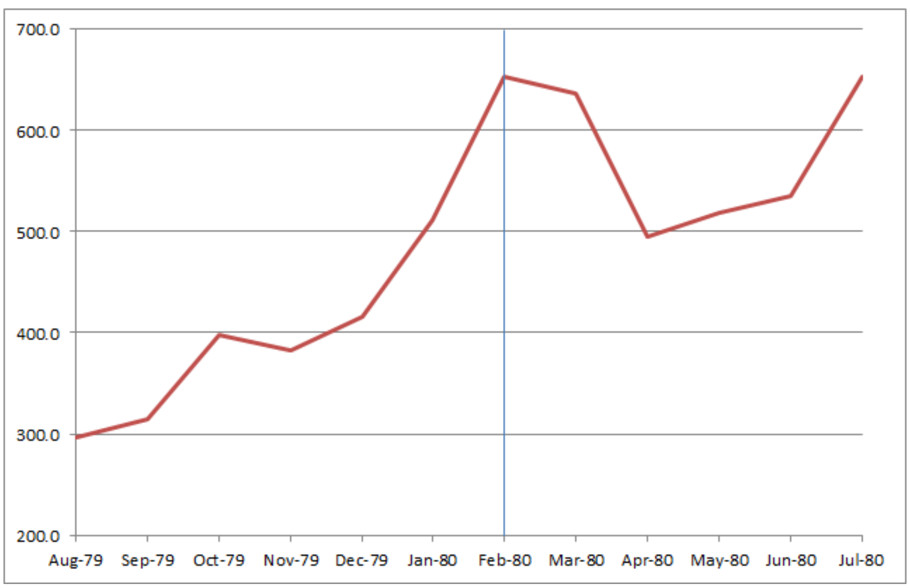
	(1)	(2)	(3)	(4)
Gold Price Random Walk Tests				
	DLF-GLS		KPSS	
Lags	Test Statistic	5% Critical Value	Test Statistic	5% Critical Value
17	-1.679	-2.816	0.236	0.146
16	-1.825	-2.821	0.246	0.146
15	-1.862	-2.826	0.258	0.146
14	-1.877	-2.831	0.271	0.146
13	-2.023	-2.836	0.286	0.146
12	-2.112	-2.841	0.304	0.146
11	-2.443	-2.846	0.325	0.146
10	-2.014	-2.850	0.350	0.146
9	-2.059	-2.855	0.380	0.146
8	-1.854	-2.859	0.417	0.146
7	-1.746	-2.863	0.464	0.146
6	-1.533	-2.867	0.524	0.146
5	-1.739	-2.871	0.605	0.146
4	-1.553	-2.875	0.718	0.146
3	-1.381	-2.879	0.887	0.146
2	-1.504	-2.883	1.17	0.146
1	-1.687	-2.886	1.73	0.146

Notes: The monthly gold price data on which the tests are conducted spans the period 1973-2005, and contains 390 observations.

Figure 1: Gold Prices: 1950-2005

Notes: Figure shows monthly gold price in USD between January 1950 and December 2005.

Figure 2: Gold Prices: RD Months

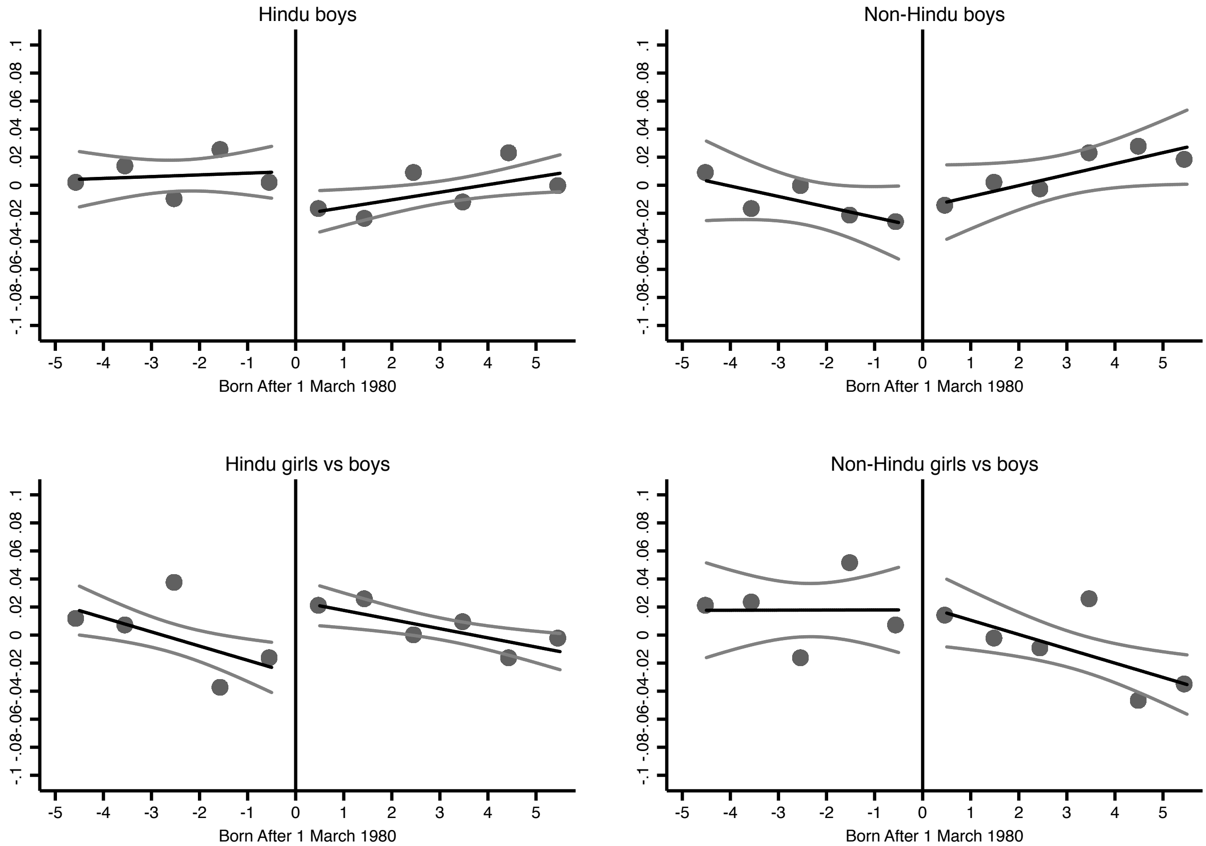


Notes: Figure shows the monthly gold price in USD between August 1979 and July 1980.

Figure 3: Gold Prices: Filtered

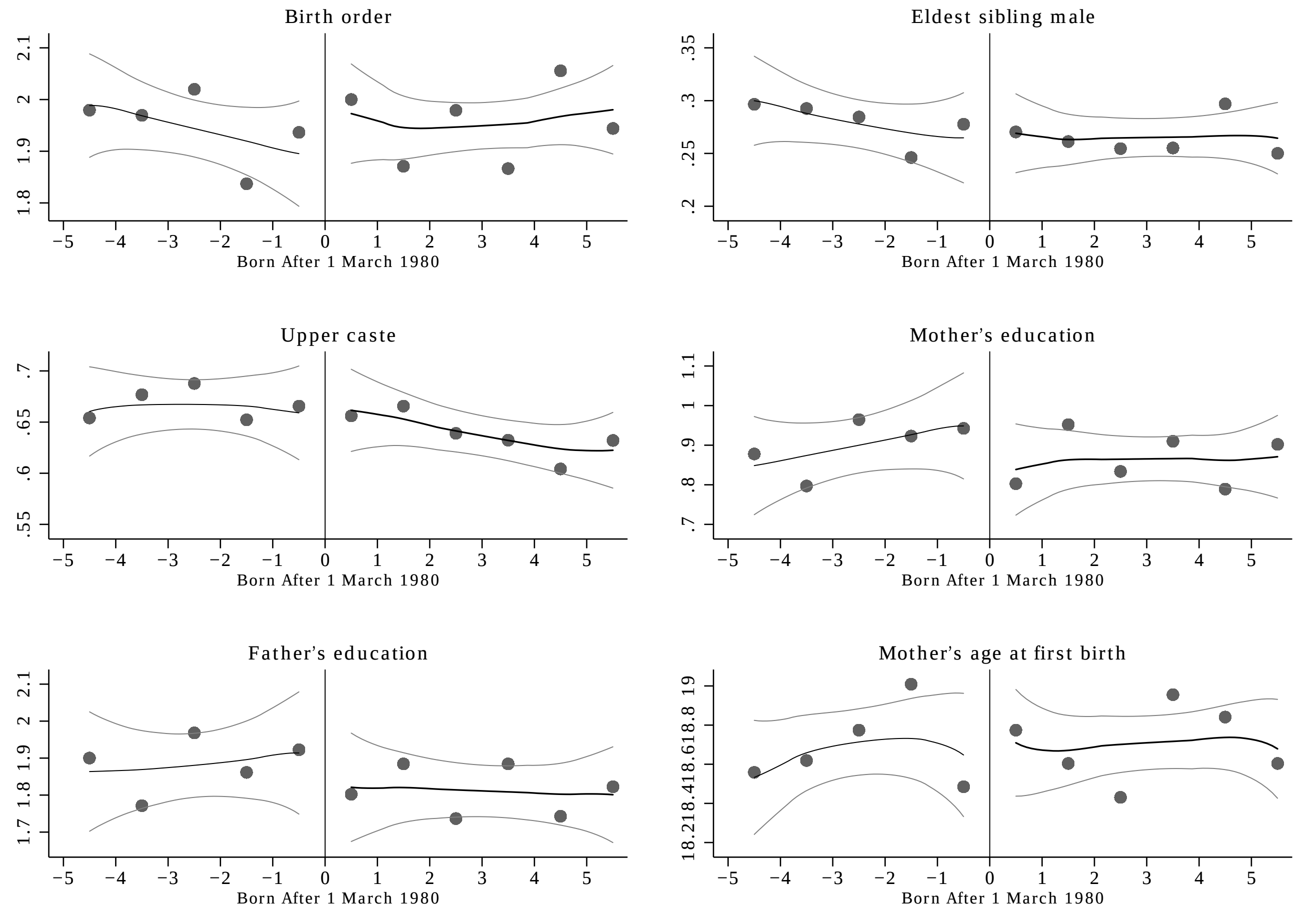
Notes: Figure shows the trend and cyclical component of real gold prices in USD between January 1970 and December 2011. Hodrick-Prescott filter with a smoothing parameter of 500 is used to construct the trend-cycle decomposition.

Figure 4: RD: Neonatal Mortality Rates, by Gender & Religion



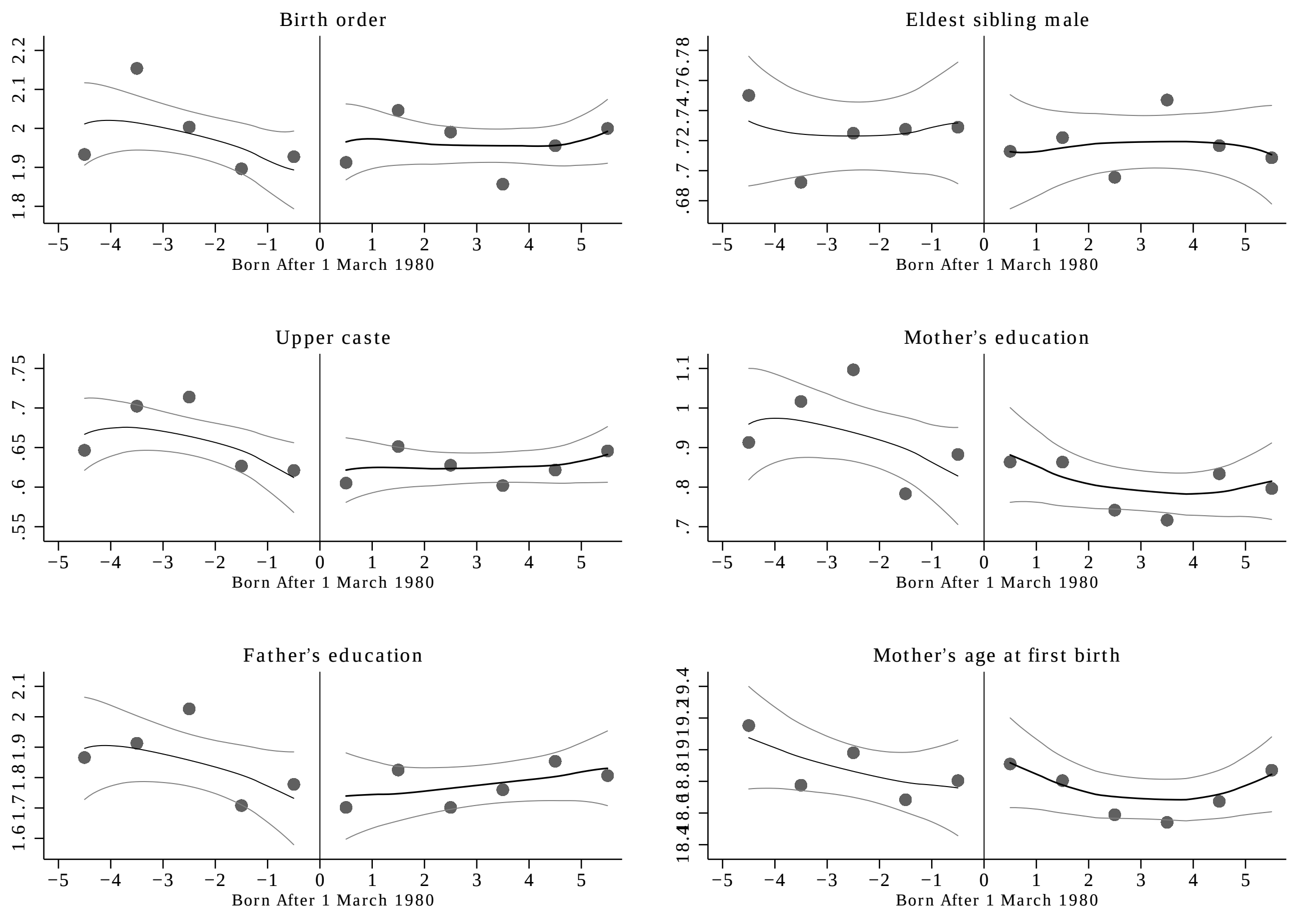
Notes: Figures show neonatal mortality rates for Hindu girls vs boys, and Non-Hindu girls vs boys samples in monthly average means against the month of birth forcing variable 5 months within the threshold of being born on 1 March 1980.

Figure 5: Covariates – Girls



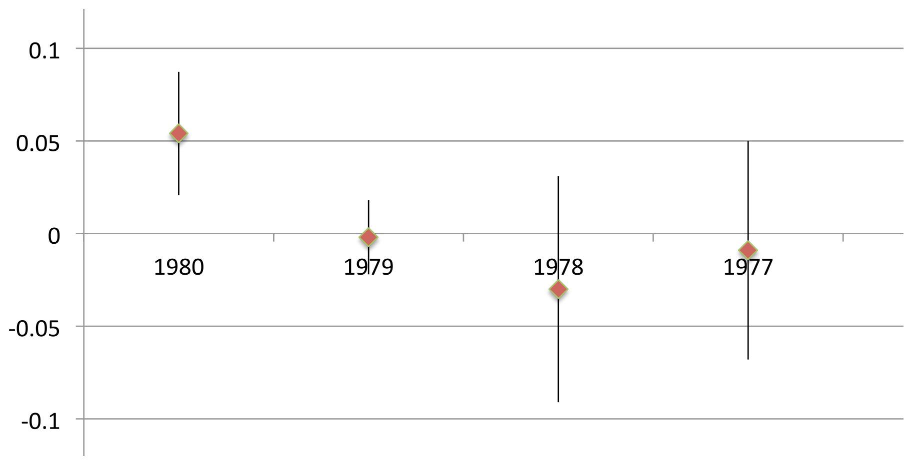
Notes: Figures show covariates in monthly average means against the monthly forcing variable 5 months within the threshold of being born on 1 March 1980 for the Hindu sample.

Figure 6: Covariates – Boys



Notes: Figures show covariates in monthly average means against the monthly forcing variable 5 months within the threshold of being born on 1 March 1980 for the Hindu sample.

Figure 7: Placebo Tests for Neonatal Mortality



Notes: Figure shows the point estimates and 95 % confidence intervals for the coefficient of Treatment × Girl from RD specification 1 estimated using Marches in 1975 - 1979 as the threshold date. The dependent variable is neonatal mortality. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment, birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the Girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the Girl child indicator. Standard errors are clustered by month-year-cohort

A Appendix: Additional Tables and Figures

Table A.1: Summary Statistics: RD Sample

	Mean	SD	Obs
Panel A: Entire Sample			
infant (0-12 months) mortality	0.099	0.299	12743
neonatal (0-1 month) mortality	0.062	0.241	12743
girl	0.480	0.500	12743
Hindu	0.781	0.414	12743
first-born male	0.511	0.500	12743
high caste	0.503	0.500	12743
Panel B: Hindu, Girls			
infant (0-12 months) mortality	0.103	0.304	4752
neonatal (0-1 month) mortality	0.060	0.237	4752
first-born male	0.276	0.447	4752
high caste	0.651	0.477	4752
Panel C: Hindu, Boys			
infant (0-12 months) mortality	0.109	0.312	5196
neonatal (0-1 month) mortality	0.071	0.256	5196
first-born male	0.725	0.447	5196
high caste	0.638	0.481	5196
Panel D: Non-Hindu, Girls			
infant (0-12 months) mortality	0.073	0.260	1359
neonatal (0-1 month) mortality	0.045	0.207	1359
first-born male	0.282	0.450	1359
Panel E: Non-Hindu, Boys			
infant (0-12 months) mortality	0.076	0.265	1436
neonatal (0-1 month) mortality	0.056	0.231	1436
first-born male	0.737	0.440	1436

Notes: The table shows the mean, standard deviation, and number of observations of key variables. The sample includes children born 6 months before and 6 months after March 1980.

Table A.2: Summary Statistics: TS Sample

	Mean	SD	Obs
Panel A: Entire Sample			
infant (0-12 months) mortality	0.067	0.250	137434
neonatal (0-1 month) mortality	0.043	0.203	137434
girl	0.480	0.500	137434
Hindu	0.751	0.433	137434
first-born male	0.512	0.500	137434
high caste	0.477	0.499	103171
Panel B: Hindu, Girls			
infant (0-12 months) mortality	0.071	0.257	49412
neonatal (0-1 month) mortality	0.042	0.201	49412
Panel C: Hindu, Boys			
infant (0-12 months) mortality	0.074	0.262	53759
neonatal (0-1 month) mortality	0.050	0.219	53759
Panel D: Non-Hindu, Girls			
infant (0-12 months) mortality	0.047	0.211	16564
neonatal (0-1 month) mortality	0.029	0.167	16564
Panel E: Non-Hindu, Boys			
infant (0-12 months) mortality	0.055	0.229	17699
neonatal (0-1 month) mortality	0.037	0.188	17699
Panel F: Gold Prices			
gold price (cyclicality)	-0.000	0 .046	408
gold price (trend)	1.317	0.262	408
Before 1985:			
gold price (cyclicality)	-0.000	0.065	168
gold price (trend)	1.453	0.292	168
After 1985:			
gold price (cyclicality)	-0.001	0.025	240
gold price (trend)	1.221	0.187	240

Notes: The table shows the mean, standard deviation, and number of observations of key variables. In Panels A-F, the unit of observation is a child and the sample includes children born between 1972 and 2005. In Panel F, the unit of observation is one month.

Table A.3: RD- Covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Birth order	Eldest sibling male	Mother's education	Father's education	Mother's age at first birth	Upper caste	Religion: Muslim
treatment	0.027	-0.006	-0.069	-0.092	0.191*	-0.002	0.009
	(0.067)	(0.011)	(0.071)	(0.067)	(0.100)	(0.025)	(0.026)
girl	-0.030	-0.473***	0.071	0.126	0.127	0.017	-0.002
	(0.026)	(0.016)	(0.087)	(0.078)	(0.260)	(0.028)	(0.025)
treatment × girl	0.027	0.019	-0.066	-0.053	-0.258	0.015	0.011
	(0.082)	(0.019)	(0.097)	(0.085)	(0.279)	(0.030)	(0.026)
Observations	12743	12743	12706	12675	12743	9948	12743
Joint p-value: treatment	0.830						
Joint p-value: treatment × girl	0.970						
Bandwidth	6	6	6	6	6	6	6

Notes: The table provides the test of balanced covariates. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment, a dummy variable for whether the child was a girl, and its interaction with the treatment dummy variable. The dependent variable in column (1) is the birth order of the child, in column (2) it's a dummy variable equal to one if the eldest (first-born) sibling of the child was a boy, in column (3) it's the child's mother's education, in column (4) it's the child's father's education, in column (5) it's the child's mother's age at her first birth, in column (6) it's a dummy variable equal to 1 if the child's parents are upper caste Hindu, in column (7) it's a dummy variable equal to 1 if the child's parents are Muslim. "Joint p-value" provides the p-value from a test of joint significance, using seemingly unrelated regressions (SUR), of "treatment" and "treatment × girl" coefficients in columns (1) to (7).

Table A.4: RD- Neonatal Mortality: Specification Checks

	Everyone		Hindus		Non-Hindus	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: 4-month Bandwidth					
treatment	-0.010	-0.033***	-0.006	-0.040**	-0.023	0.003
	(0.008)	(0.009)	(0.011)	(0.015)	(0.013)	(0.010)
girl		-0.032***		-0.056***		0.066**
		(0.006)		(0.012)		(0.024)
treatment × girl		0.047***		0.072***		-0.054*
		(0.006)		(0.013)		(0.024)
Obs	8668	8668	6748	6748	1920	1920
Bandwidth	4	4	4	4	4	4
	Panel B: Quadratic Control Function					
treatment	-0.003	-0.033***	0.047	-0.049***	-0.017	0.022
	(0.005)	(0.009)	(0.033)	(0.011)	(0.010)	(0.014)
girl		-0.049***		-0.089***		0.080**
		(0.011)		(0.016)		(0.034)
treatment × girl		0.061***		0.105***		-0.081**
		(0.012)		(0.019)		(0.035)
Observations	12743	12743	9948	9948	2795	2795
Bandwidth	6	6	6	6	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. In Panel A, the sample is restricted to children born 4 months before and four months after March 1st 1980, and all regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment. In Panel B, the sample is restricted to children born six months before and six months after March 1st 1980, and all regressions control for the quadratic trend in month of birth and its interaction with the dummy variable for treatment. All regressions also control for birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the Girl child indicator. Standard errors are clustered by month-year-cohort.

Table A.5: RD- Neonatal Mortality: Literacy Gap

	Full sample		Hindu sample		Non-Hindu sample	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: States with a Large Male-Female Literacy Gap					
treatment	-0.042**	-0.079***	-0.041**	-0.092***	-0.093***	-0.023
	(0.018)	(0.021)	(0.018)	(0.024)	(0.025)	(0.056)
girl		-0.048*		-0.061*		0.067
		(0.025)		(0.030)		(0.074)
treatment × girl		0.079*		0.108**		-0.147
		(0.038)		(0.040)		(0.101)
Observations	6334	6334	5567	5567	767	767
Bandwidth	6	6	6	6	6	6
	Panel B: States with a Small Male-Female Literacy Gap					
treatment	-0.011	-0.015	-0.017	-0.032	0.014	0.038*
	(0.008)	(0.018)	(0.013)	(0.023)	(0.019)	(0.019)
girl		-0.024		-0.043		0.026
		(0.019)		(0.028)		(0.030)
treatment × girl		0.009		0.030		-0.051
		(0.022)		(0.031)		(0.039)
Observations	6409	6409	4381	4381	2028	2028
Bandwidth	6	6	6	6	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment, a dummy variable for whether the eldest (first-born) sibling was a boy, and its interaction with the treatment dummy variable, birth order fixed effects, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the girl child indicator. Standard errors are clustered by month-year-cohort.

Table A.6: RD- Neonatal Mortality: Siblings

	Full sample		Hindu sample		Non-Hindu sample	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: No Covariates			
treatment	-0.011	-0.006	-0.018	-0.012	0.011	0.010
	(0.013)	(0.017)	(0.016)	(0.024)	(0.015)	(0.021)
treatment × girl	0.023*	0.011	0.036*	0.026	-0.024	-0.038
	(0.012)	(0.017)	(0.018)	(0.030)	(0.024)	(0.039)
treatment × no of sisters		-0.018*		-0.022**		-0.002
		(0.009)		(0.008)		(0.020)
treatment × no of brothers		0.008		0.009		0.005
		(0.016)		(0.021)		(0.022)
treatment × girl × no of sisters		0.036***		0.040***		0.019
		(0.009)		(0.009)		(0.023)
treatment × girl × no of brothers		-0.012		-0.018		0.008
		(0.017)		(0.025)		(0.036)
Observations	12743	12743	9948	9948	2795	2795
Bandwidth	6	6	6	6	6	6
			Panel B: With Covariates			
treatment	-0.029**	-0.023	-0.036**	-0.027	0.006	0.004
	(0.010)	(0.014)	(0.013)	(0.023)	(0.016)	(0.019)
treatment × girl	0.027**	0.014	0.042**	0.030	-0.046	-0.060
	(0.012)	(0.017)	(0.018)	(0.029)	(0.027)	(0.035)
treatment × no of sisters		-0.018*		-0.022**		-0.005
		(0.009)		(0.009)		(0.021)
treatment × no of brothers		0.006		0.003		0.008
		(0.017)		(0.023)		(0.021)
treatment × girl × no of sisters		0.038***		0.039***		0.025
		(0.011)		(0.011)		(0.027)
treatment × girl × no of brothers		-0.011		-0.014		0.002
		(0.018)		(0.027)		(0.029)
Observations	12743	12743	9948	9948	2795	2795
Bandwidth	6	6	6	6	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment. In addition, all regressions in Panel B control for birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the Girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the Girl child indicator. Standard errors are clustered by month-year-cohort.

Table A.7: RD- Neonatal Mortality and Adult Height, Caste

	(1)	(2)	(3)	(4)	(5)	(6)
	Hindus		Upper caste		Lower caste	
	Panel A: Neonatal Mortality					
treatment	-0.017	-0.037**	-0.010	-0.021	-0.036*	-0.072***
	(0.009)	(0.014)	(0.009)	(0.015)	(0.017)	(0.017)
girl		-0.034*		-0.041**		-0.026
		(0.016)		(0.017)		(0.028)
treatment × girl		0.043**		0.022		0.078***
		(0.018)		(0.019)		(0.024)
Observations	9948	9948	6408	6408	3540	3540
Bandwidth	6	6	6	6	6	6
	Panel B: Adult Height					
treatment	-0.754**	-0.720*	-0.850	-0.867	-0.913**	-0.768
	(0.312)	(0.388)	(0.611)	(0.524)	(0.377)	(0.506)
Observations	2732	2732	1095	1095	1637	1637
Full Controls	No	Yes	No	Yes	No	Yes
Bandwidth	6	6	6	6	6	6

Notes: In all regressions, the sample is limited to Hindu households. In Panel A, The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to Hindu families. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment, birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the Girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the Girl child indicator. In Panel B, the dependent variable is height (in centimeters) of the female respondent in NFHS. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment and state fixed effects. In addition, regressions in columns (2), (4) and (6) control for high-caste indicator (for Hindu sample), the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month along its lags for the past 12 months. Standard errors are clustered by month-year-cohort.

Table A.8: RD- Neonatal Mortality: Rice and Oil Prices

	Full sample				Hindu sample				Non-Hindu sample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
treatment	-0.011	-0.029**	-0.037***	-0.019	-0.018	-0.037**	-0.045***	-0.038	0.011	0.007	-0.004	0.036
	(0.013)	(0.010)	(0.008)	(0.025)	(0.016)	(0.013)	(0.010)	(0.041)	(0.015)	(0.016)	(0.021)	(0.032)
girl	-0.027**	-0.025**	2.022**	2.319***	-0.036*	-0.034*	1.136	1.966*	-0.000	0.019	5.597***	4.058***
	(0.010)	(0.010)	(0.687)	(0.729)	(0.017)	(0.016)	(0.861)	(0.941)	(0.022)	(0.020)	(1.304)	(0.834)
treatment × girl	0.023*	0.027**	0.035***	0.022	0.036*	0.043**	0.045***	0.053	-0.024	-0.047	-0.018	-0.069*
	(0.012)	(0.012)	(0.008)	(0.031)	(0.018)	(0.018)	(0.014)	(0.049)	(0.024)	(0.027)	(0.020)	(0.038)
Observations	12743	12743	12743	12743	9948	9948	9948	9948	2795	2795	2795	2795
Bandwidth	6	6	6	6	6	6	6	6	6	6	6	6
Basic Controls	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
Rice Price and lags	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Oil Price and lags	N	N	N	Y	N	N	N	Y	N	N	N	Y

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth, its interaction with the dummy variable for treatment. In addition, regressions in columns 2, 4, 5, 6, 8 and 9 control for birth order fixed effects, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the Girl child indicator. Regressions in columns 3, 6 and 9 control for world rice price and its lags for the past 2 months, interacted with the female child indicator. Standard errors are clustered by month-year-cohort.

Table A.9: TS: Neonatal Mortality, Full, by Religion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Hindu						Non-Hindu					
gold price	-0.026	-0.025	-0.024	-0.024	-0.029		-0.015	-0.010	-0.007	-0.008	0.002	
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)		(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	
trend of gold price	0.029	0.029	0.031	0.030	0.050**		-0.033	-0.035	-0.032	-0.031	-0.037	
	(0.019)	(0.019)	(0.019)	(0.019)	(0.023)		(0.029)	(0.030)	(0.030)	(0.030)	(0.034)	
girl	-0.003	-0.005	-0.005	-0.005	-0.010	-0.014	0.005	0.004	0.004	0.004	-0.039	-0.039
	(0.008)	(0.008)	(0.008)	(0.008)	(0.018)	(0.018)	(0.011)	(0.011)	(0.011)	(0.011)	(0.025)	(0.025)
gold price × girl	0.067**	0.066*	0.064*	0.065*	0.064*	0.064*	0.049	0.044	0.046	0.044	0.019	0.017
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.051)	(0.051)	(0.051)	(0.051)	(0.052)	(0.052)
trend of gold price × girl	-0.004	-0.003	-0.003	-0.003	0.003	0.004	-0.010	-0.009	-0.009	-0.009	0.006	0.009
	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.013)	(0.013)
first-born male		0.002	0.002	0.002	0.002	0.002		0.002	0.002	0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
high caste		-0.011***	-0.012***	-0.012***		-0.012***						
		(0.001)	(0.001)	(0.001)		(0.001)						
ln(rice) cyclical					0.015						-0.014	
					(0.016)						(0.023)	
ln(rice) trend					-0.014						0.001	
					(0.014)						(0.021)	
ln(rice) cyclical × girl					-0.011	-0.013					0.008	0.005
					(0.021)	(0.021)					(0.031)	(0.031)
ln(rice) trend × girl					-0.005	-0.004					-0.001	-0.002
					(0.004)	(0.004)					(0.006)	(0.006)
ln(petroleum) cyclical					0.015*						-0.022	
					(0.009)						(0.014)	
ln(petroleum) trend					-0.018						0.005	
					(0.012)						(0.018)	
ln(petroleum) cyclical × girl					-0.011	-0.010					0.049***	0.050***
					(0.012)	(0.012)					(0.018)	(0.018)
ln(petroleum) trend × girl					-0.000	-0.001					-0.012*	-0.011
					(0.005)	(0.005)					(0.007)	(0.007)
Observations	103171	103171	103171	103171	103171	103171	34263	34263	34263	34263	34263	34263
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes	No	No	No	No	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table A.10: TS: Neonatal Mortality, Caste

	Hindus		Upper caste		Lower caste	
	(1)	(2)	(3)	(4)	(5)	(6)
gold price	-0.029		-0.061*		0.017	
	(0.026)		(0.032)		(0.041)	
gold price × girl	0.064*	0.064*	0.087**	0.089**	0.029	0.021
	(0.034)	(0.034)	(0.043)	(0.043)	(0.055)	(0.055)
Observations	103171	103171	49167	49167	54004	54004
Month of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic CovariatesYes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend	Yes	Yes	Yes	Yes	Yes	Yes
Rice and Oil Price × Girl	Yes	Yes	Yes	Yes	Yes	Yes
Month × Year of birth fixed effects	No	Yes	No	Yes	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to Hindu families and second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table A.11: TS: Neonatal Mortality, Excluding the 1980 Shock

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Hindus						Non-Hindus					
gold price	-0.045	-0.045	-0.044	-0.044	-0.052*		-0.054	-0.049	-0.046	-0.047	-0.034	
	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)		(0.042)	(0.042)	(0.042)	(0.042)	(0.043)	
trend of gold price	0.007	0.008	0.010	0.004	0.024		-0.017	-0.022	-0.016	-0.010	-0.016	
	(0.022)	(0.022)	(0.022)	(0.022)	(0.024)		(0.032)	(0.032)	(0.032)	(0.033)	(0.036)	
girl	-0.003	-0.004	-0.004	-0.004	-0.009	-0.013	-0.002	-0.003	-0.003	-0.003	-0.042*	-0.042
	(0.008)	(0.008)	(0.008)	(0.008)	(0.018)	(0.018)	(0.012)	(0.012)	(0.012)	(0.012)	(0.025)	(0.025)
gold price × girl	0.090**	0.088**	0.087**	0.087**	0.087**	0.086**	0.062	0.055	0.057	0.055	0.023	0.023
	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)	(0.038)	(0.056)	(0.056)	(0.056)	(0.056)	(0.057)	(0.058)
trend of gold price × girl	-0.004	-0.003	-0.003	-0.003	0.003	0.003	-0.005	-0.004	-0.004	-0.004	0.010	0.011
	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)
first-born male		0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
high caste		-0.011***	-0.012***	-0.012***		-0.012***						
		(0.001)	(0.001)	(0.001)		(0.001)						
cyclical component of lnrice					0.012						-0.016	
					(0.016)						(0.023)	
trend of lnrice					-0.010						0.004	
					(0.014)						(0.021)	
lnrice cyclical × girl					-0.011	-0.014					0.009	0.007
					(0.020)	(0.021)					(0.030)	(0.031)
lnrice trend × girl					-0.005	-0.004					-0.001	-0.002
					(0.004)	(0.004)					(0.006)	(0.006)
cyclical component of lnpetroleum					0.017*						-0.020	
					(0.009)						(0.014)	
trend of lnpetroleum					-0.024*						0.003	
					(0.012)						(0.018)	
lnpetroleum cyclical × girl					-0.015	-0.014					0.046***	0.048***
					(0.012)	(0.012)					(0.018)	(0.018)
lnpetroleum trend × girl					-0.000	-0.001					-0.011*	-0.011
					(0.005)	(0.005)					(0.007)	(0.007)
Observations	100734	100734	100734	100734	100734	100734	33594	33594	33594	33594	33594	33594
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes	No	No	No	No	No	Yes

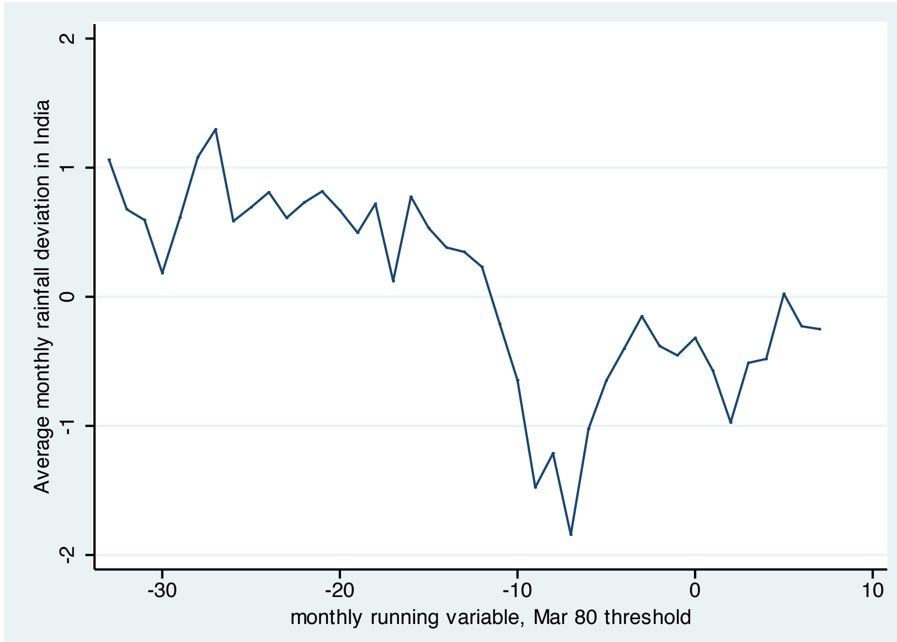
Notes: The dependent variable is a dummy variable equal to one if the child did not survive the neonatal (first month of life) period. Sample is limited to second-born children born during 1972-2005, *excluding those born 6 months before or 6 months after March 1st 1980*. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table A.12: Dowry Value and Gold Prices, Log of Gold Price

	(1)	(2)	(3)	(4)	(5)	(6)
			Log of Gold Price			
log gold price	0.443***	0.591***	1.554***	1.556***	1.508***	1.606***
	(0.104)	(0.174)	(0.269)	(0.450)	(0.369)	(0.481)
religion – hindu	-0.065	-0.145	0.229	0.219	0.228	0.220
	(0.219)	(0.215)	(0.249)	(0.247)	(0.249)	(0.248)
number of sons of household head	0.074***	0.026	-0.035	-0.039	-0.035	-0.039
	(0.025)	(0.026)	(0.038)	(0.039)	(0.038)	(0.039)
number of daughters of household head	0.016	-0.036	-0.031	-0.036	-0.031	-0.036
	(0.028)	(0.027)	(0.043)	(0.043)	(0.043)	(0.043)
age at marriage	0.071	0.098	0.122	0.115	0.123	0.115
	(0.060)	(0.061)	(0.101)	(0.102)	(0.101)	(0.102)
age at marriage squared	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003
	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
years of schooling	0.045***	0.051***	0.052***	0.053***	0.053***	0.053***
	(0.010)	(0.010)	(0.013)	(0.013)	(0.013)	(0.013)
spouses's years of schooling	0.061***	0.060***	0.047***	0.047***	0.047***	0.047***
	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)
log rice price		-0.004		-0.163		-0.170
		(0.093)		(0.280)		(0.282)
log oil price		-0.249***		0.052		0.065
		(0.088)		(0.198)		(0.201)
total annual rainfall		-0.002		-0.003		-0.003
		(0.002)		(0.002)		(0.002)
log state gdp		-0.944***		-0.089		-0.117
		(0.173)		(0.401)		(0.418)
log gold price at birth					-0.025	0.043
					(0.125)	(0.136)
Observations	4201	4201	2239	2239	2239	2239
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls	No	Yes	No	Yes	No	Yes

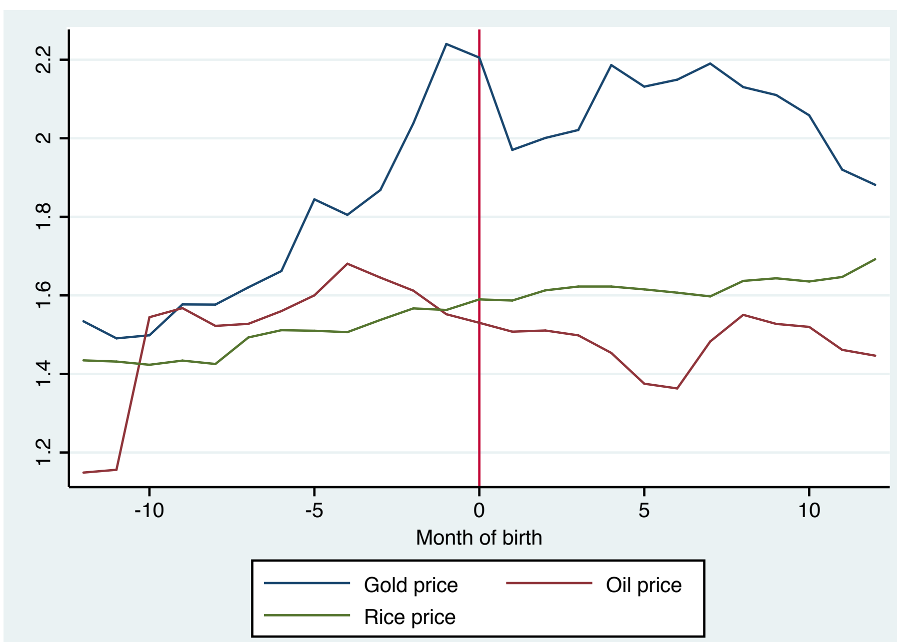
Notes: This table shows all the coefficient estimates for Panel A of Table 10. Data from 1999 wave of the Rural Economic and Demographic Survey. The dependent variable is the log real value of dowry payment made by the bride's side to the groom's side at the time of marriage. Log gold price is the log of the average monthly gold price in the year of marriage. All monetary prices are deflated using Indian CPI from World Bank Development Indicators. All regressions control for state fixed effects, caste of the bride's family and caste of the groom's family, a dummy variable taking value 1 if the bride's family is Hindu, number of brothers of the bride, number of sisters of the bride, linear and quadratic terms in the age of the bride at marriage, and years of schooling of the bride and groom. In addition, regressions in columns (2), (4) and (6) control for state GDP, state average rainfall, logs of world rice price and world oil price in the year of marriage. Standard errors are clustered by household.

FIGURE A.1: RAINFALL



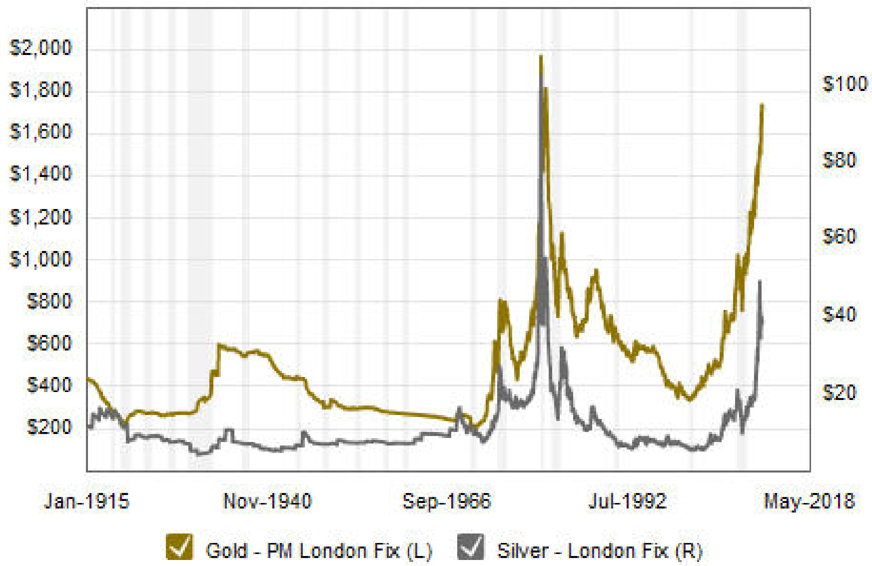
Notes: Figure shows the average difference between rainfall in a given month and past 20 years average rainfall during the same month, calculated for every state and then averaged over the country.

FIGURE A.2: RICE AND OIL PRICES



Notes: Figure shows the log of rice, oil and gold prices in the world market.

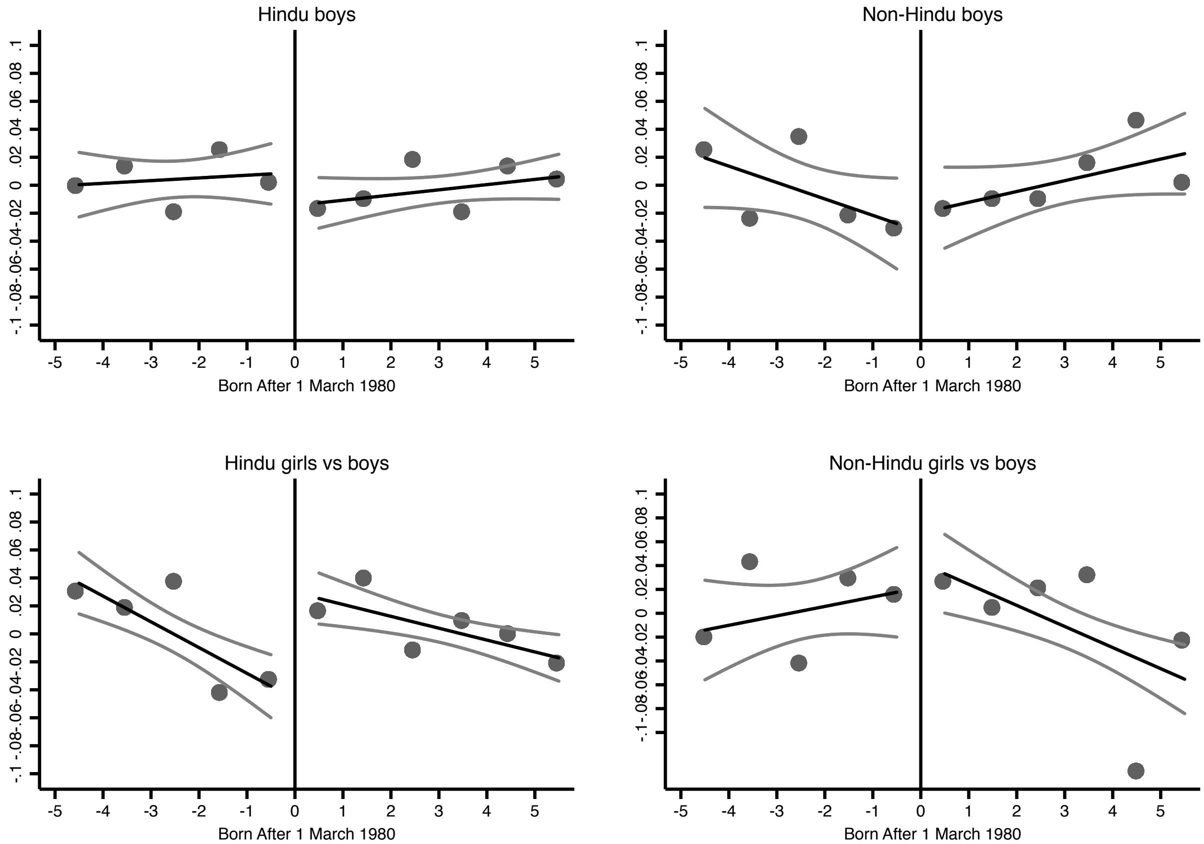
Figure A.3: Silver and Gold Prices



Notes: Figure shows gold and silver prices in USD per troy ounce from the London Stock Exchange, taken from seekingalpha.com.

B Appendix: Infant Mortality Results

Figure B.1: RD: Infant Mortality Rates, by Gender & Religion



Notes: Figures show infant mortality rates for Hindu girls vs boys, and Non-Hindu girls vs boys samples in monthly average means against the month of birth forcing variable 5 months within the threshold of being born on 1 March 1980.

Table B.1: RD- Infant Mortality

	Everyone		Hindus		Non-Hindus	
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: No Covariates			
treatment	0.015	-0.010	0.017	-0.017	-0.005	-0.009
	(0.010)	(0.013)	(0.010)	(0.017)	(0.011)	(0.025)
girl		-0.033**		-0.054**		-0.007
		(0.012)		(0.018)		(0.036)
treatment × girl		0.051***		0.072***		0.009
		(0.014)		(0.021)		(0.037)
Observations	10834	10834	8448	8448	2795	2795
Bandwidth	5	5	5	5	6	6
			Panel B: With Covariates			
treatment	0.001	-0.028**	0.006	-0.039**	-0.018	-0.006
	(0.007)	(0.010)	(0.009)	(0.015)	(0.015)	(0.026)
girl		-0.036**		-0.064***		0.002
		(0.014)		(0.017)		(0.030)
treatment × girl		0.060***		0.091***		-0.023
		(0.015)		(0.021)		(0.040)
Observations	10834	10834	8448	8448	2795	2795
Bandwidth	5	5	5	5	6	6

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the infant (first year of life) period. Treatment is a dummy variable taking value 1 if the child was born after March 1st 1980, 0 otherwise. All regressions control for the linear trend in month of birth and its interaction with the dummy variable for treatment. In addition, all regressions in Panel B control for birth order fixed effects, a dummy variable for whether the eldest (first-born) sibling was a boy, high-caste indicator (for Hindu sample), state fixed effects, the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month and its interaction with the Girl child indicator, lagged rainfall deviations for the past 12 months preceding the month of birth and their interactions with the Girl child indicator. Standard errors are clustered by month-year-cohort.

Table B.2: Time Series- Infant Mortality, by Religion

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Hindu Sample			
gold price	-0.035	-0.030	-0.030	-0.029	-0.038	
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	
gold price × girl	0.091**	0.088**	0.086**	0.086**	0.086**	0.084**
	(0.041)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)
Observations	103171	103171	103171	103171	103171	103171
			Panel B: Non-Hindu Sample			
gold price	-0.090*	-0.083*	-0.080*	-0.080*	-0.073	
	(0.047)	(0.047)	(0.047)	(0.047)	(0.048)	
gold price × girl	0.100	0.088	0.090	0.089	0.068	0.068
	(0.063)	(0.063)	(0.063)	(0.063)	(0.064)	(0.064)
Observations	34263	34263	34263	34263	34263	34263
Month of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Month × Year of birth fixed effects	No	No	No	No	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the infant (first year of life) period. Sample is limited to second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

Table B.3: Time Series- Infant Mortality: Pre and Post Ultrasound

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Infant Mortality Before 1985					
gold price	-0.044	-0.053	-0.052	-0.059	-0.080*	
	(0.043)	(0.044)	(0.044)	(0.044)	(0.046)	
gold price × girl	0.148***	0.150***	0.151***	0.153***	0.176***	0.170***
	(0.057)	(0.058)	(0.058)	(0.058)	(0.061)	(0.061)
Observations	29651	29651	29651	29651	29651	29651
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes
	Panel B: Infant Mortality After 1985					
gold price	0.012	0.024	0.025	0.031	0.036	
	(0.053)	(0.053)	(0.053)	(0.054)	(0.056)	
gold price × girl	-0.103	-0.118	-0.116	-0.115	-0.142*	-0.141*
	(0.073)	(0.073)	(0.073)	(0.073)	(0.076)	(0.077)
Observations	73520	73520	73520	73520	73520	73520
Birth month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Basic Covariates	No	Yes	Yes	Yes	Yes	Yes
Rainfall × Girl	No	Yes	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	Yes	Yes	Yes
Quadratic trend	No	No	No	Yes	Yes	Yes
Rice and Oil Prices × Girl	No	No	No	No	Yes	Yes
Birth month × year fixed effects	No	No	No	No	No	Yes

Notes: The dependent variable is a dummy variable equal to one if the child did not survive the infant (first year of life) period. Sample is limited to Hindu families and second-born children born during 1972-2005. "gold price" refers to the cyclical component of the detrended monthly gold price in US dollars, deflated using US CPI and decomposed into its cyclical and trend components using a Hodrick-Prescott filter with a smoothing parameter of 500. All regressions control for state fixed effects, the trend of gold price and its interaction with the girl child indicator. "Basic Covariates" include a dummy variable for whether the eldest (first-born) sibling was a boy and the high-caste indicator. The linear and quadratic trends are state-specific. Specifications with "Rice Price" and "Oil Price" control for the cyclical and trend components of world rice and oil prices. "Rainfall" controls for the difference between rainfall in the month of birth and past 20 years average rainfall in that state-month, and lagged rainfall deviations for the past 12 months preceding the month of birth.

C Appendix: A Simple Model

In this section we sketch two simple models. In the first, parents value the welfare of their children equally, but are obliged by convention to pay dowry when their daughter's marry and this raises the cost of daughters. In the second, there is exogenous son preference i.e. parents attach greater weight to the welfare of sons but there is no dowry and gold is simply a commodity that parents consume. In the first model, an increase in the relative price of dowry raises excess girl mortality and in the second, income effects of gold price can generate excess girl mortality (among net purchasers of gold) as long as parents prefer sons.

C.1 Case I: Gold for Dowry

Parents have utility $u(x, w)$, where x is consumption of a numeraire good and w is child welfare, and they earn income y. The real price of gold is p. Child welfare w is produced using gold and consumption as inputs. The effective price of w is $a + bp$, where $a > 0$ is a constant, $b > 0$ if the child is a girl and a dowry is paid at her marriage, and $b < 0$ if the child is a boy and he receives a dowry at marriage. If parents have rational expectations and gold prices follow a random walk then w will respond to the current gold price.

If we assume a Cobb-Douglas parental utility function so that $u(x, w) = x^{\alpha}w^{1-\alpha}$, the optimal investment in child welfare is:

$$w^*(p) = \frac{y}{(1-\alpha)(a+bp)}$$

so that the comparative statics yield $(\partial w^*/\partial p) < 0$ if the child is a girl, and $(\partial w^*/\partial p) > 0$ if the child is a boy. We are assuming that b does not adjust to changes in p, for example because social norms dictate the content of dowry. We test this and the random walk assumptions.

C.2 Case II: Gold for Consumption

We now switch off the dowry channel by assuming that parents consume gold for other reasons, such as to gain social status by exhibiting jewelry. Parental utility is given by $u(x, g, \theta w)$, where θ measures preference for children, and is exogenously higher for sons than daughters, g is the quantity of gold and p is its current price. In the absence of dowry, the price of child welfare w is a constant a. Households respond to the current gold price p. Let $z = \theta w$, or "effective" child welfare, be the choice variable. The Slutsky equation for an increase in the gold price is then:

$$\frac{\partial z}{\partial p} = \frac{\partial h}{\partial p} - \frac{\partial z}{\partial y}g$$

If households are large net gold buyers, the income effect may dominate the substitution effect and we will then have $\frac{\partial z}{\partial p} < 0$. The impact of actual child welfare is:

$$\frac{\partial w}{\partial p} = \frac{1}{\theta} \frac{\partial z}{\partial p}$$

which is *less* negative for boys than for girls. Hence income effects of gold price increases can generate excess girl mortality in the absence of dowry. However this mechanism would lead to boys also having higher mortality as a result of gold price increases; a prediction that is rejected in the data.